TRANSMISSION SERVICE – MODULE 2

Transmission Rights Reconfiguration – Describes the implementation of the reconfiguration service: mechanisms for determining pre-existing obligations, auction rules and pricing of IWRs sold and purchased. A series of auctions addresses different time periods:

- Annual for monthly on-peak and off-peak IWRs.
- Monthly for monthly on-peak and off-peak IWRs for the balance of the annual period of the auction cycles.
- Intra-monthly for daily on-peak and off-peak IWRs for the balance of a month.
- Day-Ahead for hourly IWRs for the next day. The Day-Ahead Reconfiguration Service (DA-RCS) will have an enhanced feature to enable trading of scheduling flexibility options.

Day-Ahead Redispatch – Describes the day-ahead redispatch service envisioned in the original Regional Proposal and explains how the objectives of day-ahead redispatch will be met by enhancements to the Day-Ahead Reconfiguration Service without encountering the difficulties of reconciling day-ahead bids with real-time imbalances that were discovered during TSLG's Layer 1 work.

Bilateral Trading – Evaluates the effects of Grid West proposed services and functions on current bilateral trading practices within the Grid West Managed Transmission System.

Rights Data Management – Describes the processes and functions used by Grid West to manage transmission rights data, including:

- Inventorying of the injection and withdrawal commitments associated with pre-existing agreements and obligationsl
- Certification of existing rights to enable the release of scheduling flexibility options into the day-ahead reconfiguration auction.
- Translation of certified existing transmission rights into IWRs, either in whole or in part, prior to release into reconfiguration auctions.

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1.0 EXECUTIVE SUMMARY

In this white paper, we describe the proposed design of Grid West Transmission Rights Reconfiguration Service (RCS) that is intended to facilitate acquisition of transmission rights by Transmission Customers.[1]

The principal attributes of the proposed Grid West Reconfiguration Service are as follows:

- Transmission rights offered into RCS are translated into standardized tradable instruments called "Injection/Withdrawal Rights (IWRs)" to facilitate their trading;
- Scheduling flexibility associated with Grid West certified existing transmission rights (CETR), called "Existing Scheduling Flexibility (ESF)," can be directly offered into RCS for trading;
- In RCS, Grid West trades IWRs and ESFs through a centralized flow-based clearing auction that combines offers for IWRs and ESFs and the GWMT Available Flow Capacities (AFCs) to match bids to acquire IWRs;
- The RCS auction objective is to maximize the value of all IWR trades; hence, priority to buy IWRs goes to those who value these IWRs the most (bids to buy them at higher prices) and priority to sell IWRs or ESFs goes to those who offer to sell them at lower prices;
- Transmission Customers who choose not to participate in RCS retain their CETRs and their associated scheduling flexibilities for use in energy scheduling;
- Transmission Customers can choose not to offer their IWRs, whether voluntarily translated from their existing rights or acquired through other mechanisms, into RCS;
- Transmission Customers who voluntarily translate part or all of their existing rights into IWRs and then choose not to offer such IWRs into RCS retain their existing transmission rights and their associated scheduling flexibilities;
- Transmission Customers whose offered IWRs and/or ESFs are not traded in the RCS will retain their CETR and their associated scheduling flexibilities for use in energy scheduling;
- Transmission Customers whose offered IWRs and/or ESFs are only partially traded in the RCS will retain and adjust CETR, which reflects the remaining flexibility of their original CETR for use in energy scheduling;
- In order to enable Transmission Customers to acquire IWRs in a timely fashion, Grid West allows trading of IWRs of various durations, from one hour to one year, through multiple RCS timelines;
- RCS includes market rules that address known market power concerns; and

[1] Given the differently situated regulatory regime in Canada and British Columbia, in particular, the operating assumption is that the Grid West market design will be mirrored in British Columbia, to the extent possible within that regulatory regime. Details regarding the market design in British Columbia are anticipated to be completed as part of detailed design phase of this effort.

- To the extent possible, RCS leverages existing business processes and technology solutions from existing RTOs and ISOs in order to minimize its overall cost of implementation and operation.

2.0 PROBLEM STATEMENT

One of Grid West's primary region-wide responsibilities is to improve the availability of transmission capacity to all transmission customers in order to enable efficient energy transactions within its regional footprint. Given the fundamental requirement that all transactions that schedule to use the Grid West Managed Transmission System (GWMT) must have applicable physical transmission rights, it is then necessary for Grid West to offer services that will greatly facilitate the trading of transmission rights among willing Transmission Customers. Grid West's Reconfiguration Service (RCS) is the most important component of such services.[2]

3.0 OBJECTIVES AND DESIGN CRITERIA

Reconfiguration service allows IWRs to be awarded to Transmission Customers[3] using the IWRs and ESFs offered into the market by other Transmission Customers as well as available capacity in GWMT. In order to provide reconfiguration services, Grid West will set up a sequence of markets and operational protocols to match bids and offers of IWRs with various time spans. The trading algorithm, a clearing auction, is designed to match IWR bids with IWR and ESF offers and AFCs in the most economically efficient manner[4] while complying with all physical and contractual constraints that govern the operation of the GWMT. The critical design criteria for RCS are:

- RCS should, to the extent possible, use standardized tradable instruments to facilitate trading of transmission rights;
- RCS should use a centralized auction to facilitate trading of IWRs among Transmission Customers by combining the IWR and ESF offers and the GWMT Available Flowgate Capacities (AFCs) [5] to award IWR bids;
- RCS should maximize the value of IWR trades as its objective;

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[2] Another major Grid West service that supports the RCS function is Rights Data Management (RDM). RDM is presented in a companion white paper.

[3] Transmission Customer refers to all entities that use the GWMT. These include all entities that are currently classified as Transmission Customers (load and supply) as well as the load-serving functions of the existing TOs.

[4] For our purposes, economic efficiency refers to maximizing value of transmission rights trade whereby available transmission resources are allocated to those who have the most valuation of such resources. This objective is also known as maximizing "social welfare" or "market surplus."

[5] Available flow capacity refers to the capacity on transmission flowgates that are not reserved by existing transmission rights or not reserved by IWRs acquired through all available means of acquiring IWRs including previous RCS auctions.

- RCS should allow the Transmission Customers who choose not to participate in RCS, to retain their Grid West certified existing transmission rights (CETRs) and their associated scheduling flexibilities;
- RCS should be voluntary;
- RCS should allow Transmission Customers whose offered IWRs and/or ESFs[6] are not traded in the RCS to retain their CETR and their associated scheduling flexibilities;
- RCS should allow Transmission Customers whose offered IWRs and/or ESFs are only partially traded in the RCS to retain adjusted CETR with adjusted associated scheduling flexibilities based on the extent of the partially traded rights;
- RCS should enable Transmission Customers to acquire IWRs of desired durations and in a timely fashion to the extent possible;
- RCS should include market rules that address known market power concerns; and
- RCS should, to the extent possible, leverage existing business processes and technology solutions from existing RTOs and ISOs.

The proposed RCS solution, as presented in this white paper, is intended to satisfy all the above design objectives and criteria.

4.0 RCS PROCESS AND METHODOLOGY

RCS consists of processes and functions that allow Transmission Customers to voluntarily trade (acquire or release) physical transmission rights within GWMT. A normal prerequisite for efficient trading of physical transmission rights is the introduction of "standardized tradable instruments" that can be readily understood and traded in primary and secondary markets by Transmission Customers. Grid West has introduced the Injection/Withdrawal Right (IWR) as such a standardized instrument.[7] An IWR represents the scheduling right to inject power at a scheduling point (bus or hub) in the GWMT and withdraw the same power at another scheduling point (bus or hub) in the GWMT within an applicable timeframe. A complete definition of the IWR along with its attributes is presented in the accompanying Grid West Glossary document. In addition Grid West is allowing the scheduling flexibilities held within existing transmission rights (ESFs) to be offered into some RCS processes.

RCS consists of processes and functions that allow Transmission Customers to acquire or release physical transmission rights in GWMT in the form of IWRs and/or ESFs. In each RCS

[6] The holder of ESF may not be the same entity as the owner of the associated transmission right.
[7] While standardized trading is the main benefit of adopting IWRs, Grid West initially moved towards IWRs for two practical reasons: (1) better alignment between schedules and actual system use should improve reliability, and (2) elimination of the dual constraints of maintaining schedules and actual flows separately, each within limits, should improve throughput. Once flow-based scheduling was decided upon, the use of IWRs was a natural consequence. The need to specify IWRs in a way that produces standardized products was then recognized. For additional details please study the accompanying market overview paper.

process, a Transmission Customer can offer for sale the applicable[8] IWRs that they own or have acquired through any of the following means:

1. IWRs that have been voluntarily translated based on all or parts of their CETR;[9]
2. IWRs that have been acquired through transmission expansion projects;
3. IWRs that have been bilaterally acquired and registered with Grid West;
4. IWRs that have been voluntarily translated by the new owners of the bilaterally traded CETR;[10] and
5. IWRs that have been acquired from previous RCS auctions.

Grid West combines all offered IWRs with the Available Flowgate Capacities (AFCs) of the GWMT to conduct its RCS auction. In addition, Grid West, as part of Day-Ahead reconfiguration service, allows its participants to offer the existing scheduling flexibilities (ESFs) that they hold into the IWR auction.[11]

In order to allow for timely and efficient acquisition of IWRs, Grid West performs the reconfiguration service on regular intervals through the following processes:

- Annual Reconfiguration Service (A-RCS): A-RCS is conducted once a year and is intended to trade monthly peak and off-peak IWRs (24 products) for all 12 months of the operating year.
- Monthly Reconfiguration Service (M-RCS): M-RCS is conducted once a month and is intended to trade monthly peak and off-peak IWRs for each of the remaining months of the operating year.
- Intra-Monthly Reconfiguration Service (I-RCS): I-RCS is conducted on daily basis and is intended to trade daily peak and off-peak IWRs beginning with two days after the auction each of the days in the remainder of the operating month.

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[8] Applicability applies to the timeframe and time format of the IWR vis-à-vis the specific RCS timeline. For example monthly peak IWRs can be offered in annual and monthly IWR auctions; however, they cannot be offered into the daily IWR auction.

[9] The process of translating existing rights into IWRs is covered in an accompanying white paper on Rights Translation.

[10] Bilateral trading of CETRs requires the approval of the impacted Transmission Owner and Grid West.

[11] In the future ESFs may be offered into other RCS process timelines.

- Day Ahead Reconfiguration Service (DA-RCS): DA-RCS is also conducted on daily basis and is intended to trade IWRs on an hourly basis for the 24 hours of the next day.

After the DA-RCS and up to scheduling deadline, IWRs may still be bilaterally acquired outside RCS processes. These bilaterally traded IWRs must be registered with Grid West before the "registration deadline" if they are to be used for energy scheduling. During the same time period, Transmission Customers are able to also acquire non-firm rights from Grid West to use for their energy scheduling.

Figure 4a presents the relative sequence and timelines of the A-RCS, M-RCS, I-RCS and DA-RCS processes.[12]

[12] In this paper and in Figure 1, we have assumed that annual RCS process is based on the "water year" (September 1st through August 31st). Other alternative annual duration can readily be used.

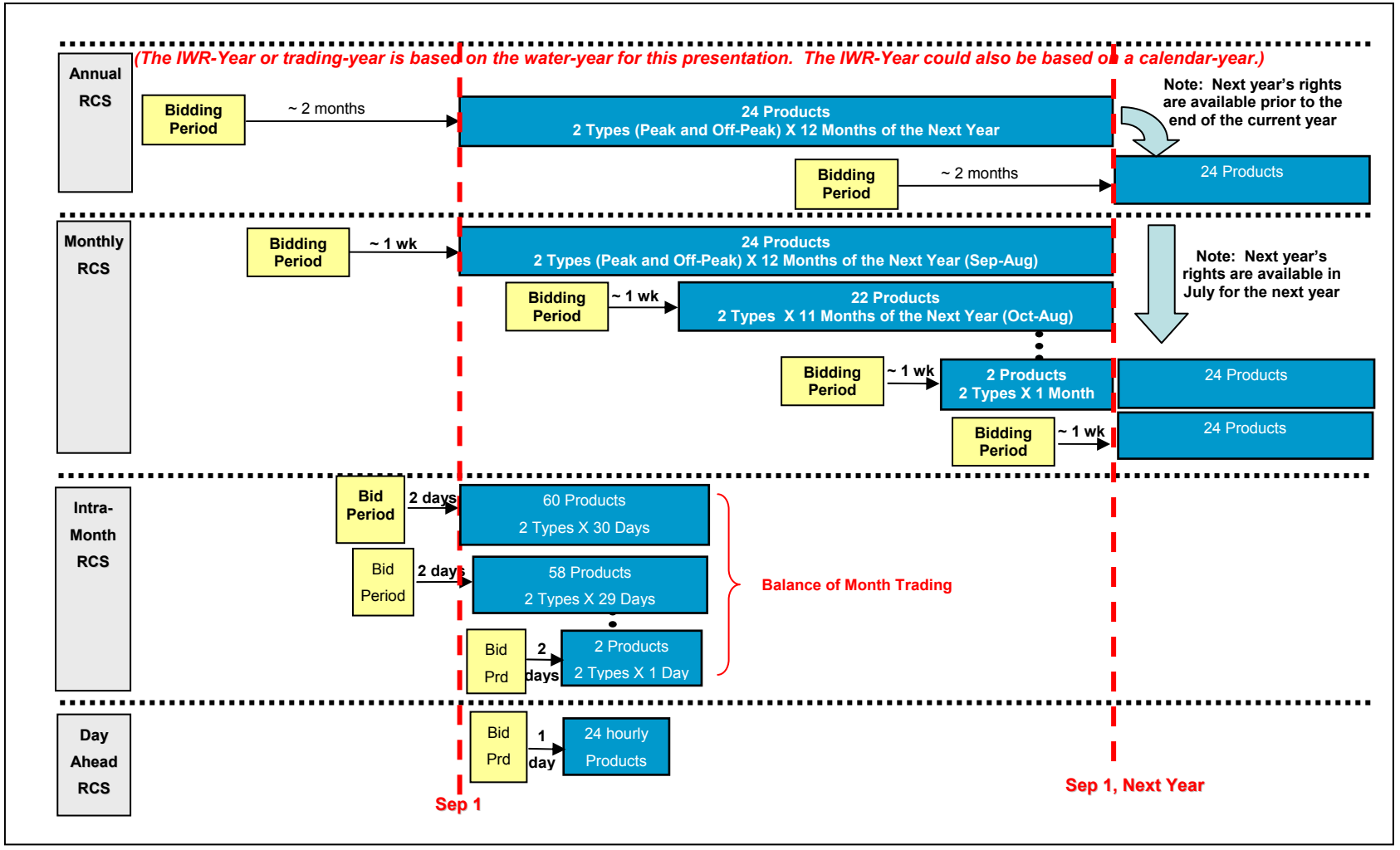

Figure 4a - RCS timelines

The proposed process flow diagram for a typical RCS process is presented in Figure 4b, which applies to all four RCS timelines. Figure 4b also shows the approximate timeline for these processes, which are as follows:

1. Development of a Transmission Rights Basecase (TRB) by Grid West for each RCS auction. This process should be performed well in advance of each RCS auction: at least two weeks for A-RCS, one week for M-RCS, one day for I-RCS and eight hours before DA-RCS.
2. Calculation and Posting of Available Flow Capacities by Grid West for each RCS auction. This process is performed right after TRB is complete.
3. Submittal of IWR offers and bids by Transmission Customers through a secure Web delivery system and during the applicable time window. Deadlines for such submittals are dependent on the RCS timeline and would vary from one day for the A-RCS and M-RCS to one hour for I-RCS and DA-RCS. Transmission Customers may also offer their existing scheduling flexibility (ESF) into DA-RCS by specifying and submitting their Intended Retained Rights (IRRs). IRRs would be presented as a set of injections and withdrawals (or a range of values for injections and withdrawals) at applicable scheduling points.
4. Validation of IWR offers and bids and ESF offers (IRR submissions) by Grid West to ensure that all offers and bids are valid and comply with all rules of the RCS process. Validation of IWR offers and bids and IRR submissions is performed virtually at the time of these submissions to ensure that they are compatible with the underlying rights data.
5. Execution of IWR Auction by Grid West during the relevant time window for the specific auction.
6. Posting of IWR auction awards and prices by Grid West no later than one hour after the auction is complete for DA-RCS and I-RCS and no later than a few days after the auction is completed for M-RCS and A-RCS.
7. Updating of the Rights Data Management (RDM) Database[13] with the updated IWR awards.

[13] Please refer to the accompanying Rights Data Translation Management (RDTM) white paper for the detail of such data.

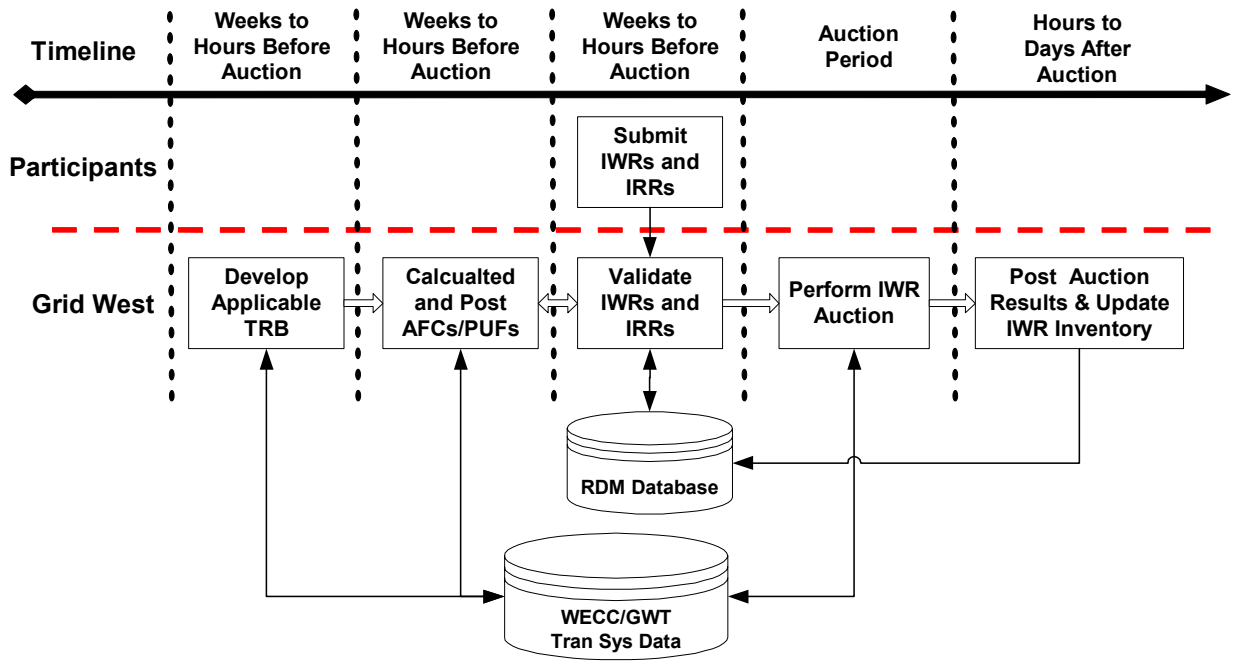

Figure 4b - RCS Process Flow and Timeline

RCS processes are described in greater detail in the following sections. These processes are essentially the same for A-RCS, M-RCS and I-RCS as they apply to the applicable auction scenarios within these reconfiguration processes. However, DA-RCS has several unique features due to its consideration of ESFs. These unique features are covered in Section 4.6.

4.1 Transmission Rights Basecase (TRB) Development

Transmission Rights Basecase (TRB) is the foundation of the IWR auction process. The TRB not only provides the transmission system data used by the IWR auction model but also is used to identify the AFCs that the model will use for the IWR auction.[14] TRB is developed using one or more "power flow" saved cases representing the WECC transmission system for the operating condition of the relevant auction scenario with emphasis on modeling of the GWMT.[15]

Starting from a full WECC case, Grid West will develop the base transmission system data that will be used for each auction scenario within various RCS processes. The data will include

[14] The RCS processes presented in this white paper are based on study of the system under normal operating conditions and a linearized network model (DC Power Flow). Alternatively, these studies can be performed by including system contingency conditions and/or with an AC Power Flow model.

[15] The WECC transmission system beyond GWF may be represented in full or with a simplified equivalent model. A full WECC network model provides a more complete solution especially as related to WECC loop flows; however, it will also require more computational power and frequent information updates from neighboring transmission operators (directly or through WECC) and an enhanced computing capability.

system topology data, transmission line parameter data and the relevant load distribution factors.[16]

4.2 AFC Calculation and Posting

Before IWR auctions, Grid West will compute and post AFCs and Path Utilization Factors ("PUFs"). Grid West will calculate AFCs in two steps for A-RCS, M-RCS and I-RCS markets and in a single step for DA-RCS. In Step 1, Grid West's goal is to account for flowgate capacities subscriptions due to Transmission Owner (TO) Obligations and Transmission Customer CETRs.[17] Given the historical knowledge of GWMT use for TO obligations and CETRs, Grid West can estimate the capacity subscriptions for these rights and the remaining AFCs using an approach called X-factor discounting - this approach is presented further below in this section. In Step 2, Grid West's goal is to account for the subscribed flowgate capacities due to "active IWRs."[18] In this step, Grid West assumes that IWRs will be used in ways other than their traditional ETR use, if applicable, after acquisition by Transmission Customers and hence IWRs are treated differently than TO obligations and ETRs and as "non-simultaneous physical rights."[19] Special power flow solutions are used to determine the subscribed flowgate capacities due to IWRs.

The two steps of AFC calculation are presented in additional detail below:

Step 1: Grid West will set up the power flow case using the TRB for each auction scenario. All TO obligations and CETRs, adjusted for active IWRs[20], are simultaneously modeled in this case. In modeling adjusted TO obligations and CETRs for an auction scenario, we use their expected configuration of these obligations and rights for that auction scenario as specified by the TOs and the CETR holders and then adjust them for active IWRs. The model accounts for counterflow effects of the adjusted TO obligations and CETRs.

The power flow analysis calculates the unsubscribed transmission capacity on all transmission flowgates. Available flow capacities are subsequently discounted based on the X-factor methodology that takes into account historical use of the flowgate. X-factor approach is summarily presented in Section 4.2.1 below. If, at this stage, a transmission flowgate is

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[16] For A-RCS and M-RCS, typical peak and off-peak basecases are developed for the applicable monthly auction scenarios. For I-RCS daily peak and off-peak basecases are developed for each auction day. Alternatively the same peak and off-peak basecases can be used for the all days covered in the I-RCS. Grid West can potentially develop as many as 24 hourly basecases for DA-RCS. We expect, however, that the same basecase will be by and large used for all 24 hours IWR auctions.

[17] CETRs correspond to those existing transmission rights (ETRs) that have been specifically identified and certified by Grid West based on request by their owners and in coordination and approval of the impacted Transmission Owners. Once certified, TO obligations are adjusted to account for the certification. Please review the accompanying paper on Rights Data Management white paper for additional details.

[18] Active IWRs are those awarded as part of a previous IWR auction, traded bilaterally and registered with Grid West, and those translated IWRs that are offered into the current RCS process. All long-term IWRs acquired as part of the Grid West capacity expansion service are also counted as part of the Active IWRs.

[19] Non-simultaneous physical rights refer to rights whose counterflow subscriptions on a flowgate are ignored while their same direction subscriptions on a flowgate are additive. This characteristic of non-simultaneous physical rights is similar to Option FTRs traded and used in the PJM market.

[20] Adjustment to account for active IWRs corresponds to taking out the rights associated with active IWRs from TO obligations and CETRs.

oversubscribed, the AFC for that flowgate is set to zero. Finally, the AFC in the opposite direction of the dominant flow is set equal to line TFC. The example of Appendix A elucidates this step.

Step 2: This step of AFC calculation entails accounting for all active IWRs. Another power flow analysis, in which all active IWRs are treated as non-simultaneous physical rights (counterflow effects are not accounted for), will identify flowgate capacity subscriptions due to these IWRs and, as a result, the AFC in both directions on all identified transmission flowgates. Here again, if a transmission flowgate is oversubscribed in any direction, the AFC for that flowgate is set to zero.[21]

The power flow analysis used to calculate will also calculate the Path Utilization Factors (PUFs) for the set of monitored flowgates and identified scheduling point (buses/hubs). For a monitored flowgate, each PUF signifies flow contribution on that flowgate as a fraction of the injection (or withdrawal) at a scheduling point within GWMT. The AFCs and PUFs calculated in this fashion are used in the IWR auction process and will be posted through the Grid West market information system and all relevant OASIS sites.[22]

The example of Appendix A should help elucidate the process of Step 2.

4.2.1 X-Factor Methodology

Intended to account for diversity in the use of existing rights, whether as TO obligations or CETRs, X-factor methodology entails discounting AFCs calculated in Step 1 of AFC calculation for all flowgates where counterflows were present. In effect AFCs are discounted using a fractional multiplier (X-factor) specifically calculated for that flowgate. For these flowgates, X-factors reflect the fact that transactions based on adjusted TO obligations and CETRs may not occur simultaneously and hence their full counterflow impact should be discounted.[23] For a flowgate where all the flows are predominantly in the same direction, the X-factor can be greater than one (1) to account for the fact that all these additive transactions may not occur simultaneously either.

Basically flowgate X-factors account for the following sources that influence actual use of a flowgate versus the net subscriptions calculated for that flowgate, as calculated from the power flow analysis:

- Simultaneity of the actual transactions based on transmission rights that are used to calculate flowgate subscription; and
- Flowgate capacity due to stochastic and "unscheduled" events such as system outages or loop flows.[24]

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[21] Given the IWR auction methodology, over-subscription at this stage should not happen unless there are changes in system configuration since the last IWR auction. There is no need to account for X-factor in these calculations.
[22] It is expected that all existing OASIS sites that cover GWMT will be consolidated into Grid West market information system (MIS).
[23] In practice rather than discounting the AFC after accounting for ETR subscriptions [DEFINE SUBSCRIPTION], the X-factor may be used to discount the counterflows when calculating the subscription. The value of X-factor for a flowgate that is used in this fashion will be different from the X-factor which is calculated in process above and can be calculated using off-line power flow studies based on historical use of GWMT.
[24] In accounting for loop flows it is important that we account for the operation of phase shifters.

X-factor for a flowgate is calculated by comparing historical flows with calculated subscriptions, from the power flow analysis of Step 1, on that flowgate. Under this methodology, every flowgate will have its own X-factor value for each RCS auction scenario. X-factor values should be updated at regular intervals using power flow studies and actual use information of the GWMT and more importantly the outcome of schedule adjustment/curtailment process. If there are extensive schedule adjustments or curtailments during the schedule adjustment/curtailment process, the X-factors should be reduced. If there are consistent unscheduled transmission capacities during the schedule adjustment/curtailment process, X-factors may be increased.[25]

4.3 IWR Validation

IWR validation verifies IWR offers and bids and ESF offers (IRR submissions) before they are used in the IWR auction. The IWR validation function entails verifying the following attributes of the IWR:

- Participant Validation: Validate that the entity offering or bidding IWR or ESFs is an authorized Transmission Customer; and verify that the entity has the proper trading rights and meets credit requirements to fully or partially participate in the RCS.
- IWR/ESF Value Validation: Validate that the offered IWR/ESF actually exists based on the physical rights inventory database (RDM database).
- Ownership Validation: Validate that the entity offering IWR/ESF is the "registered owner" of the right per Grid West physical right inventory database (RDM database).
- Timeframe Validation: Validate that the offered IWR is applicable to the timeframe of the auction. Timeframe applies both to the scenario dimension as well as the duration dimension of the IWR.
- Syntax Validation: Validate data entry syntax.

Only IWRs offers and bids and ESF offers (IRR submissions) that pass all these validation steps will be allowed in and used in the IWR auction.

4.4 IWR Auction

The IWR auction uses a linearized Optimal Power Flow (DC OPF)[26] model that represents the physical characteristics of the transmission system in a DC power flow framework to perform the auction.[27] The auction matches IWR and ESF offers, IWR bids and AFCs with the objective of maximizing the value of traded transmission rights subject to all contractual and physical constraints of the transmission system.[28]

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[25] Hence there will be knowledge-based judgment applied in the calculation of X-factors.
[26] One form of model that is well established and may be used is a DC Optimal Power Flow that simulates flow distribution effects without adding the complexity of modeling nonlinear AC effects.
[27] Losses are ignored in the IWR auction.
[28] The solution methodology is essentially the same as the algorithms used by existing RTOs and ISOs for auctioning Option based Financial Transmission Rights (FTRs). These algorithms also use an optimal power flow model (usually a linearized/DC OPF) for the FTRs auction to ensure that the awarded FTRs, if actually realized as physical transactions, do not violate system operating constraints (i.e. there is no over-subscription of transmission flowgates). The objective of these FTR auctions is to ensure revenue adequacy for the RTO/ISO as the RTO/ISO

An IWR auction is conducted for each relevant auction scenario; for example, there are 24 auction scenarios (monthly peak and off-peak for the next 12 months) for the annual RCS. Auction scenarios are either solved separately or tied together if IWR offers or bids require it. For example, if one or more Transmission Customers offer to sell or bid to buy 24 equal IWRs for all of the 24 auction scenarios in the annual RCS (annual IWR strip/block), the auction model will tie all 24 auction scenarios together for the annual RCS.[29] The same principles apply to monthly RCS except that, rather than solving for each month of the 12 months of the year, it is done for each month for the remaining month(s) of the year. IWRs translated from CETRs, and all applicable awarded IWRs from previous RCS processes or those applicable IWRs acquired through bilateral trades, and registered with Grid West, can be offered in the intra-monthly auction as daily peak and off-peak IWRs.

In intra-monthly RCS auctions, peak and off-peak IWRs are auctioned on a daily basis for the remaining days of the month (balance of the month starting from the second day after the auction).[30] Hence, for a particular intra-monthly RCS, there could be as many as 62 peak and off-peak auction scenarios, depending on the length of the months and the day when the auction is performed. IWRs translated from CETRs, and all applicable awarded IWRs from previous RCS processes or those applicable IWRs acquired through bilateral trades, and registered with Grid West, can be offered in the intra-monthly auction as daily peak and off-peak IWRs.

In DA-RCS process, IWRs are auctioned on an hourly basis for the next business day[31] (24 auction scenarios). IWRs translated from existing rights, applicable IWRs awarded through previous annual, monthly and intra-monthly RCS processes or acquired through bilateral trades, can be offered in the Day-ahead auction as a string of hourly IWRs. ESFs can also be offered in the DA-RCS.

IWR sellers will receive the difference in clearing prices at the relevant scheduling points for the awarded IWRs. These clearing prices are standard output of the DC-OPF model that is used for the IWR auction. Buyers of IWRs will pay difference in clearing prices at the relevant scheduling points for the IWRs purchased through the IWR auction.

Those who release ESF into DA-RCS will receive payments equivalent to difference between maximum value of their flexible rights, as determined based on all IWR bids and offers and the value of their intended retained rights (IRRS).[32]

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has to pay owners of the FTRs based on congestion revenues in the DA energy market. In Grid West's case, the objective of the IWR auction is to ensure that maximum IWR awards are made and the identified transmission flowgates are not oversubscribed. Given that all transactions need to have existing transmission rights or IWRs before being accepted for scheduling, this should prevent over-scheduling of transmission flowgates.

[29] Solving all scenarios together entails significant added complexity for the solution algorithm.

[30] Note that these auctions will be performed on weekdays only.

[31] Note that these auctions will be performed on weekdays only. As a result, if daily auctions are desired for weekend days, three daily auctions will be performed on Fridays (one for the next Saturday, one for the next Sunday and one for the next Monday).

[32] This payment is mathematically calculated using the value of the AFCs that is released on the congested flowgates by the ESF offer/release and is calculated as the product of the magnitudes of released AFCs on all congested flowgates and the shadow price of these flowgates. Shadow price of a flowgate is the value of increasing the capacity of the flowgate capacity by one MW and is a by-product of the DC-OPF that performs the IWR auction.

4.5 Auction Results Posting

All IWR awards will be privately communicated through timely posting on the secure part of the Grid West market information system (MIS) - please refer to the accompanying white paper on MIS. Public IWR information, e.g., clearing prices for scheduling points, and the total IWR quantities awarded in the auction will be posted on the public side of Grid West market information system and all applicable OASIS sites. The same information is also deposited into the RDM database for use in the next rounds of the RCS or for operational purpose.

4.6 DA-RCS Distinctive Features

There are several features in the DA-RCS process that are distinct from those of the other RCS processes. These distinct features of the DA-RCS are:

- Existing scheduling flexibilities (ESFs) of CETRs are allowed to be offered into DA-RCS by allowing ESF holders to specify/submit their intended retained rights (IRRs);
- TO obligations and CETRs are modeled with the full range of their scheduling flexibility for the AFC calculation as opposed to their expected value; and
- AFCs and PUFs are calculated in a single step and based on the assumption that translated ETRs and IWRs can create counterflow flowgate subscriptions (X-factors are again used to account for the fact the counter flows may not be simultaneous).

To accommodate these features, the DA-RCS auction model, although still DC OPF based, will use some form of an "internal dispatch model" to account for rights scheduling flexibility. The example of Appendix B should help elucidate these specific features.

5.0 INPUTS AND OUTPUTS

All RCS processes have similar input and output data. DA-RCS has a few additional input data requirements. Figure 4b showed the data flow diagram for a typical RCS process. In the following tables, we define each one of the inputs and outputs of these processes and present specific details for individual RCS timelines.

5.1 RCS Input

Table 5.1 presents the inputs to the RCS process.

Table 5.1 - Inputs to the RCS process

Input	Description	Timeline Differentiators
TO obligation	Aggregated transmission obligations of the TOs (stemming from existing contracts, coordination agreements, treaties, etc.) presented via the expected I/W obligation values (or range of	**A-RCS:** Expected monthly peak/off-peak I/W obligation values at all relevant scheduling points for every month of the year. **M-RCS:** Expected monthly peak/off-peak I/W obligation values at all relevant scheduling points for the remaining months of the year. **I-RCS:** Expected TO obligation daily

	values) at all relevant scheduling points and for the relevant auction scenario.	peak/off-peak I/W values at all relevant scheduling points for the remaining days of the month. **DA-RCS:** Actual TO obligation peak/off-peak I/W values or range of values at all relevant scheduling points.
CETR	Existing Transmission Rights of Transmission Customers as certified by Grid West and presented as the I/W right values (or value ranges) at all relevant scheduling points as well as overall rights constraint for the ETR.[33]	Applicable for DA-RCS only.
IWRs	Injection right value at one scheduling point and an equal withdrawal right value at another scheduling point for each of the applicable auction scenarios.	**A-RCS:** Monthly peak/off-peak IWRs for every month of the year. **M-RCS:** Monthly peak/off-peak IWRs for the remaining months of the year. **I-RCS:** Daily peak/off-peak IWRs for the remaining days of the month. **DA-RCS:** Hourly IWRs for the next business day.
Transmission System Data	"Power flow" type data for the WECC transmission systems. All GWMT to be presented. WECC system outside GWF may be presented in full or converted into an equivalent model for ease of analysis. Other transmission related data include the appropriate flowgate flow limits from the AFC calculation and outage schedules. X-factors for all "monitored" flowgates calculated based on offline studies is included as part of this information.	**A-RCS:** System topology, transformer and phase shifter tap positions, and X-factors for the 24 auction scenarios. **M-RCS:** System topology; transformer and phase shifter tap positions, and X-factors for the auction scenarios of the remaining months of the year. **I-RCS:** System topology; transformer and phase shifter tap positions, and X-factors for the auction scenarios of the remaining days of the year. **DA-RCS:** System topology; transformer and phase shifter tap positions, and X-factors for the next business day.

[33] Please refer to the accompanying Rights Data Translation Management (RDTM) white paper for the detail of such data.

Offers to sell IWR	Injection right and withdrawal right values at two specific scheduling points that corresponds with the IWRs owned by the offering entity per RDM database.	**A-RCS:** Monthly peak/off-peak IWR offers for every month of the year. **M-RCS:** Monthly peak/off-peak IWR offers for the remaining months of the year. **I-RCS:** Daily peak/off-peak IWR offers for the remaining days of the month. **DA-RCS:** Hourly IWR offers for the next business day.
Intended Retained Rights [IRR]	For DA-RCS, IRRs represent the rights that the Transmission Customers who hold the ESFs in the CETRs intends to keep for their own scheduling. IRRs are specified by the range of intended schedules (I/W values or range of values) at one or more applicable scheduling points.	Applicable for DA-RCS only.
Bids to buy IWRs	Injection right and withdrawal right values (equal values) at two specific transmission points in the system.	**A-RCS:** Monthly peak and/or off-peak IWR bids for one or more months of the year. **M-RCS:** Monthly peak and/or off-peak IWR bids for one or more months in the remaining months of the year. **I-RCS:** Daily peak/off-peak IWR bids for one or more days in the remaining days of the month. **DA-RCS:** Hourly IWR bids for one or more hours of the next business day.

5.2 RCS Output

Table 5.2 presents the outputs of a typical RCS process.

Table 5.2 - Outputs of the RCS process

Output	Description	Timeline Differentiators
AFCs & PUFs	Available flow capacity for the "identified flowgates" in the GWF transmission system as well as PUFs for the same flowgates and identified scheduling points (buses/bubs) - public data.	**A-RCS:** AFCs & PUFs for annual auction scenarios. **M-RCS:** AFCs & PUFs for monthly auction scenarios. **I-RCS:** AFCs & PUFs for intra-monthly auction scenarios.

		DA-RCS: AFCs & PUFs for daily auction scenarios.
Awarded IWRs	The "matched/reconfigured" IWRs (injection and withdrawal right values at the requested scheduling points) and the corresponding prices- private data.	**A-RCS:** Monthly peak/off-peak IWR awards for every month of the year. **M-RCS:** Monthly peak/off-peak IWR awards for the remaining months of the year. **I-RCS:** Daily peak/off-peak IWR awards for the remaining days of the month. **DA-RCS:** Hourly IWR awards for the next business day.
Awarded Scheduling Flexibility	The final retained right (RR) range per scheduling point and the payment amount for the flexibility released into DA-RCS - private data.	Applicable for DA-RCS only.
IWR Prices	IWR clearing prices - private data.	**A-RCS:** Monthly peak/off-peak clearing prices for all IWR scheduling points for all scheduling points for every month of the year. **M-RCS:** Monthly peak/off-peak clearing prices for all IWR scheduling points for all scheduling points for the remaining months of the year. **I-RCS:** Daily peak/off-peak clearing prices for all IWR scheduling points for all scheduling points for the remaining days of the month. **DA-RCS:** Hourly clearing prices for all IWR scheduling points for the next business day.
Auction summary	AFCs, total awarded MW for each flowgate, clearing prices for all scheduling points plus other summary information for the applicable auction scenarios will be posted onto market information system (MIS) - public data.	**A-RCS:** Monthly peak/off-peak AFCs and PUFS, total awarded MW for each flowgate, clearing prices for all scheduling points plus other summary information for all months of the year. **M-RCS:** Monthly peak/off-peak AFCs and PUFS, total awarded MW for each flowgate, clearing prices for all scheduling points plus other summary information for the remaining months of the year. **I-RCS:** Daily peak/off-peak AFCs and PUFS, total awarded MW for each flowgate, clearing prices for all scheduling points plus other summary information for the remaining

		days of the month. **DA-RCS:** Hourly AFCs and PUFS, total awarded MW for each flowgate, clearing prices for all scheduling points plus other summary information for the next business day.

6.0 ROLES AND RESPONSIBILITIES

Table 6 describes the roles and responsibilities of Grid West and its participants in the RCS process.

Table 6 - Grid West and its participants' roles and responsibilities in RCS

RCS Timeline	Grid West	Transmission Owners	Transmission Customer
Pre-Auction	▪ Develop TRB basecase ▪ Publish basecase ▪ Calculate and post AFCs and PUFs	▪ Provide data and assist with building TRB and calculation of AFCs and PUFs ▪ Provide base data used for validation	▪ Monitor
Auction	▪ Validate bids/offers ▪ Carry out auction	▪ Monitor	▪ Submit IWR bids/offers ▪ Submit IRRs for DA-RCS
Post Auction	▪ Post IWR awards and prices and other market information ▪ Post retained rights and payments for DA-RCS	▪ Monitor	▪ Download market results

7.0 REVENUE ALLOCATION

IWR auction over a period is expected to produce net revenue for Grid West due to the sale of AFCs as part of the IWR auction. Such net revenues, if any, will be used to reduce Regional Revenue Requirement Adjustment account (R3A).

8.0 MARKET POWER AND MARKET EFFICIENCY CONSIDERATIONS

Market monitoring processes and mitigation rules are integral parts of all competitive markets. Market mitigation measures have been used proactively (market rules) and reactively (sanctions

and penalties) to ensure that markets are free of market power abuses. On the negative side, market mitigation measures, whether proactive or reactive, have the tendency to limit the competitiveness of the markets, so there should be a balance between rules to mitigate market power and the need for the market to behave "competitively" without undue administrative interventions.

The Grid West reconfiguration service, as presented in this white paper, is intended to complement existing transmission rights trading in GWF. As such we do not foresee that RCS itself would create additional opportunities for market power abuses. Nevertheless, the following market mitigation processes should be considered for the Grid West RCS to address any lingering concerns:

- Monitoring and potentially limiting of IWR ownership concentration among Transmission Customers especially for those with dominant energy positions;
- Monitoring of purchase, resale and use patterns of IWRs by Transmission Customers especially for those with dominant energy positions; and
- Monitoring IWR auction participation, awards and prices, with the possibility of instituting price caps and/or other mitigation measures if needed to address identified problems.

9.0 MARKET BENCHMARKS

The underlying approach that Grid West uses to account for transmission rights is different from those of the existing RTOs and ISOs in North America. At the heart of this difference is that transmission rights in existing RTOs and ISOs are solely intended to provide a financial hedge against ex-post congestion charges. Hence, market participants in these RTOs and ISOs do not need to own transmission rights in order to schedule their transactions with their RTO or ISO.[34]

Since most FTRs offered by existing RTOs and ISOs are purely financial instruments, practically every MW of the transmission system capacity is available for the FTR auction (and later for the Day-Ahead energy auction). Hence, the FTR auctions are normally performed in segments where portions of the available transmission capacity are auctioned off. In addition, due to the financial nature of FTRs, most existing RTOs and ISOs only conduct annual and monthly FTR auction for seasonal or monthly peak and off-peak FTRs. On the other hand, since Transmission Customers do need transmission rights for scheduling purposes, Grid West needs to conduct additional auctions close to scheduling time in order to ensure that market

[34] Financial rights in these RTOs and ISOs are referred to as Financial Transmission Rights (FTRs) and they are normally in the form of point-to-point (a point may be a bus, a zone or a hub) Obligation FTRs. Only CAISO and ERCOT currently offer transmission rights that are slightly different. In the case of CAISO, the transmission right (called Firm Transmission Right) provides its holder with scheduling priority as well. In ERCOT, transmission rights (called Transmission Congestion Rights) are Flowgate rights. Holders of FTRs receive payment equal to the amount right ownership and the value of FTR as determined by Locational Marginal Prices or LMPs. The funds to pay FTR holder are collected as congestion charges from market participants in the RTO/ISO Day-Ahead (DA) energy market. In rare instances, an Obligation FTR holder may have to pay for transmission system congestion if his/her right is in the direction of counterflow on a congested flowgate. In the process of transmission rights administration by these RTOs and ISOs, holders of existing rights, such as LSEs or direct retail customers, are often offered Auction Revenue Rights (ARRs) and/or FTRs equivalent for their existing rights to account for their existing rights.

participants have access to sufficient mechanisms (e.g., RCS processes) to purchase transmission rights.

Furthermore, Grid West's DA-RCS process, which allows ESFs to be offered into the IWR auction, is not comparable to any transmission rights trading mechanism used by existing RTOs and ISOs.

Despite these dissimilarities in the fundamental application of transmission rights, there are underlying similarities in processes that Grid West uses for auctioning transmission rights and those used by existing RTOs and ISOs. These similarities, presented in table 9a below, allow most computational tools and techniques used by the existing RTOs and ISOs to be, by and large, usable for Grid West in its various RCS processes.

Table 9a - Comparison of Grid West RCS process and FTR trading by existing RTOs/ISOs

Auction Attribute	Grid West	PJM	ERCOT	MISO
IWR Auction Mechanism	OPF-based clearing auction with the objective of maximizing IWR auction value	Option-based FTR auction engine uses fundamentally the same OPF-based clearing auction algorithm as the one used for IWR auction.		
Auction Pricing	Based on clearing price differences at the corresponding scheduling points of the IWR.	Based on the difference in LMPs at the two ends of the FTR.		
Revenue Allocation	Net revenue from IWR auction is applied towards R3A.	Any net revenue goes towards paying down the embedded cost of the transmission system.[35]		

Table 9b shows the FTR products and the frequency of trading these products by some of the existing RTOs and ISOs.

Table 9b - FTR products and their Frequency of Trading

RTO/ISO	Frequency of FTR Auction	FTR Duration (Months)
MISO	Annual	12
	Monthly	1
ISO-NE	Annual	12
	Monthly	1
NYISO	Semi Annual	6 - 12

[35] Existing RTOs and ISOs normally pay the net FTR auction revenues to ARR holders - normally those who own existing rights such as LSEs.

	Monthly	1 60
PJM	Annual Monthly	12 1
ERCOT	Annual Monthly	12 1
Grid West (IWR Trading)	Annual (A-RCS) Monthly (M-RCS) Daily (I-RCS) Hourly (DA-RCS)	12 1 1 day 1 hour

10.0 TECHNOLOGY SOLUTIONS

As described earlier, the technologies required for the RCS implementation are by and large already available and are in use by the industry. Relational databases that would house the transmission owner obligations and translated transmission rights data (RDTM database) can be readily procured and designed. Transmission System Database is a standard construct of most power flow solution vendors. Standard secure Web interfaces can be used to exchange private and public input and output data with Transmission Customers.

Participants' input data validation process uses straightforward algorithms and relies on the RDM database. In addition, IWR auction model for A-RCS, M-RCS and I-RCS is rather a complex model; however, such a model is already in use by existing RTOs and ISOs.

Grid West's DA-RCS auction process, on the other hand, has the unique feature of accounting for scheduling flexibilities and as such requires special new modeling features that we believe can be readily added to the existing auction models offered in the industry.

11.0 ORGANIZATION REQUIREMENTS

Table 10 presents the resource requirements for the operation and support of RCS business processes and technologies.[36]

Table 11 - RCS Staff Requirements

Division	Department	Role	Responsibility
Market Operations	Forward Markets	Manager	▪ RCS management

[36] We assume that Grid West will acquire, rather than build, all the technology resources needed for the RCS functionality. This assumption is essential in re-sourcing the operation of the RCS process and its technologies. We have not included administrative requirements in this table. We have not included the infrastructure (LAN/WAN, office automation, etc.) support requirements either. The Division and Departments will be further defined in the Organizational Design process.

Market Operations	Forward Markets	Analyst (2)	▪ Basecase development
Market Operations	Forward Markets	Analyst (5)	▪ AFC/PUF calculation and posting ▪ IWR validation ▪ IWR auction & posting
Information Technology	Market Systems	Analyst (2)	▪ Application support
Information Technology	Market Systems	Analyst (1)	▪ Database support

12.0 COST DRIVERS

We have already identified some of the cost drivers that would impact the set up and operation of the RCS for Grid West. A preliminary list of such cost drivers include:

- System Redundancy: Redundant systems improve market response; however, they can be costly. For market solutions such as RCS, one could use cold standby and non-clustered solution to reduce cost. No redundancy should be required for the Secondary (fail-over) site of the RCS operation. In addition, ASP or outsourcing services for some systems can further reduce startup and potentially ongoing costs. Data redundancy can also be provided in a cold stand-by mode so far as near-synchronous data replication is in place between primary and backup system in the Primary site and to the system in the Secondary site.
- Staff Redundancy: Staff redundancy ensures smooth and long-term operation of RCS. Redundancy of staff can be minimized if timing of various RCS auction functions is planned to ensure that same resources can cover multiple functions.
- RCS Operation Timing: Limiting the time of RCS to business hours on weekdays will reduce resource (staff and applications and infrastructure) requirements and will help manage startup and ongoing costs.
- Complexity of Solution: A careful balance should be extended against rigor with which the application models are built and run and cost of attaining such a rigorous solution (that may still only be an approximation of the reality). For the RCS process, consistency is just as important as accuracy. One area for savings is the use of DC versus AC power flow based solutions for RCS auctions.
- Market Monitoring: The more extensive the market monitoring scope, especially the scope of after-the-fact surveillance, the higher the cost of the underlying system. If the bulk of market monitoring is in the form of preventive and auditable market rules, less effort will be extended for market monitoring.
- Participants System Access: The more direct and high speed access into Grid West is provided to Transmission Customers, the more the infrastructure and application costs. Internet, once properly secured through straightforward measures, offers a very reliable and inexpensive access media for market participants in the RCS auction.

- Multi-purpose System Use: Various RCS processes (A-RCS, M-RCS, I-OCS and DA-RCS) can use the same system and staff resources. In order to achieve this goal, it is imperative that the timing of various RCS auctions be carefully aligned so that the same resources can be used for all RCS auctions. Table 12 presents one such timing arrangement.

Table 11 - RCS execution time

RCS Timeline	Run Date	Run Date
Annual RCS	Once a year (non-Friday weekday in June)	2-5 PM (potentially repeated multiple times)
Monthly RCS	Once a month (a non-Friday weekday in the last full week of the month)	11AM-1PM (potentially repeated multiple times)
Intra-monthly RCS	Daily on business days	9AM - 10AM
Day-ahead RCS	Daily on business days	7 AM - 8 AM

13.0 REMAINING ISSUES

- Pricing of existing scheduling flexibility (ESF): Further work is required to determine whether an ESF can be released into DA-RCS along with a price offer versus as a price taker - as it is the case in the examples presented here.
- Calculation of adjusted CETRs due to each RCS auction is not a simple linear process and needs careful examination

Appendix A - EXAMPLE OF RCS

In this appendix, we will present a simple end-to-end example that covers the principal functions of the RCS process. This example is applicable to A-RCS, M-RCS and I-RCS. The example of DA-RCS is presented in Appendix B. All of these examples assume that the reader has a basic acquaintance with the calculation of power flows in a simple network. For non-technical readers unfamiliar with such calculations, Appendix C has been provided as an introduction to the basic concepts used. Non-technical readers may find it beneficial to read Appendix C before reading the other two appendices.

Pre-Auction:

Figure A-a shows a threebus system with three equal impedance transmission flowgates (paths). The Total Flow Capacity (TFC) is also shown on each flowgate.

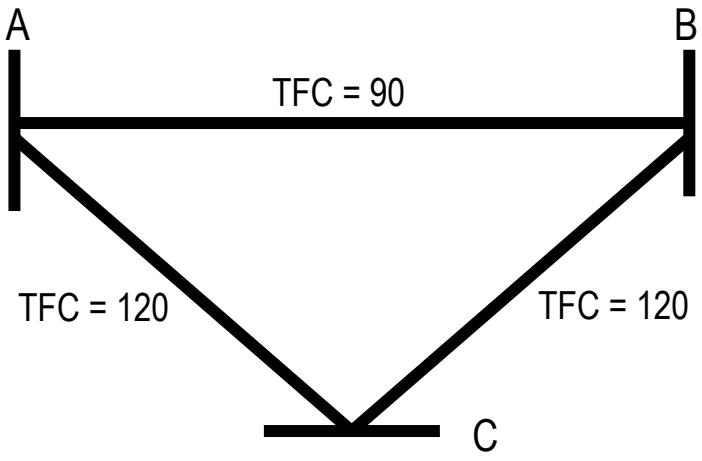

Figure A-a - Transmission Rights Basecase

Let's assume that these are three existing transmission rights (ETRs)[37] - all are point to point:

- ETR1: 60 MW from bus A to bus C
- ETR2: 60 MW from bus C to bus B
- ETR3: 60 MW from bus A to bus B

Now let's assume that ETR3 has been voluntarily translated by its owner into an IWR of the same magnitude from bus A to bus B. Also let's also assume that 30 MW of the translated IWR has been sold in a previous RCS process.

[37] For the purpose of these examples we have interchangeably used ETRs and TO obligations.

Step 1 of the AFC calculation process involves simulating non-translated existing rights ETR1 and ETR2 and the non-traded portion of ETR3 as shown in Figure A-b.

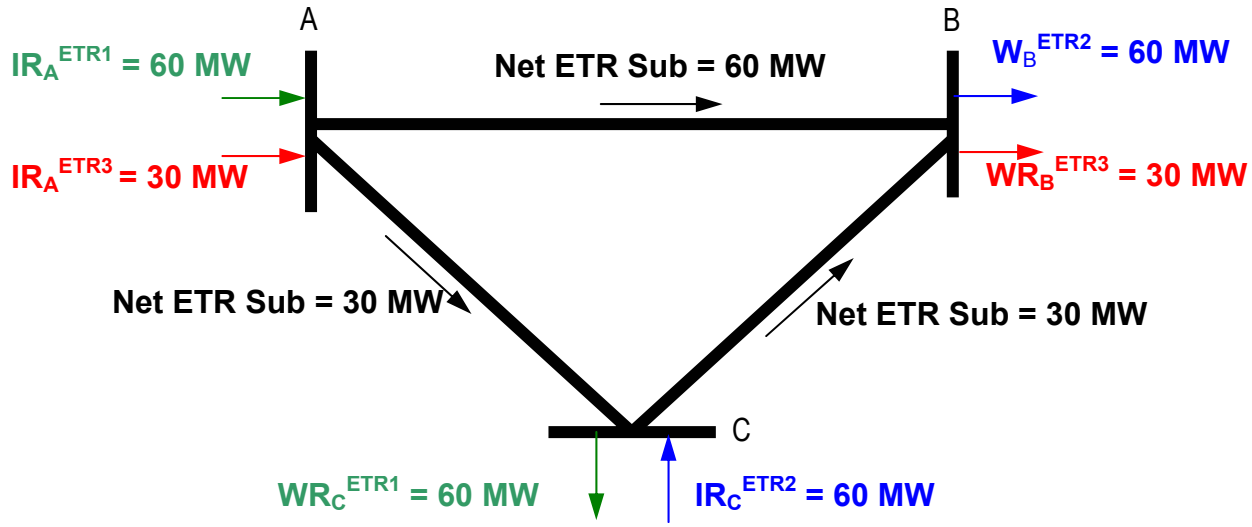

Figure A-b - ETR Flowgate Subscriptions

Table A-a presents the process of calculating AFCs using the methodology described in Section 4.2. In this and all subsequent tables "AFC^+" refers to AFC in the direction of the arrow shown and "AFC^-" refers to AFC in the opposite direction to the arrow. The same convention is used for subscriptions (Sub) in this and all subsequent figures.

Table A-a - AFC after accounting for ETRs

Flowgate	TFC in both directions	Net ETR Sub^+	AFC^+	AFC^-	X-Factor for AFC^+	AFC^+ after X-Factor	AFC^- after X-Factor
A - B	90 MW	60 MW	30 MW	90 MW	1.0	30 MW	90 MW
A - C	120 MW	30 MW	90 MW	120 MW	0.9	81 MW	120 MW
C - B	120 MW	30 MW	90 MW	120 MW	0.9	81 MW	120 MW

Step 2 in the calculation of AFCs involves accounting for traded, awarded or acquired IWRs (namely, all rights that have not been considered so far). Let's assume that in addition to the portion of ETR3 that had been traded as IWR (IWR1), there is another IWR (IWR2) from bus C to Bus B for 30 MW (acquired previously). The two new IWRs are

- IWR1: 30 MW from bus A to bus B
- IWR2: 30 MW from bus C to bus B

Figure A-c offers the IWRs and their flowgate usage. Note that in this figure the counterflow contribution of IWR2 on flowgate A-C has been ignored while all same direction flow

contributions are added up. Table A-b presents the process of calculating the final AFCs. Table A-c presents table of PUFs for this example.

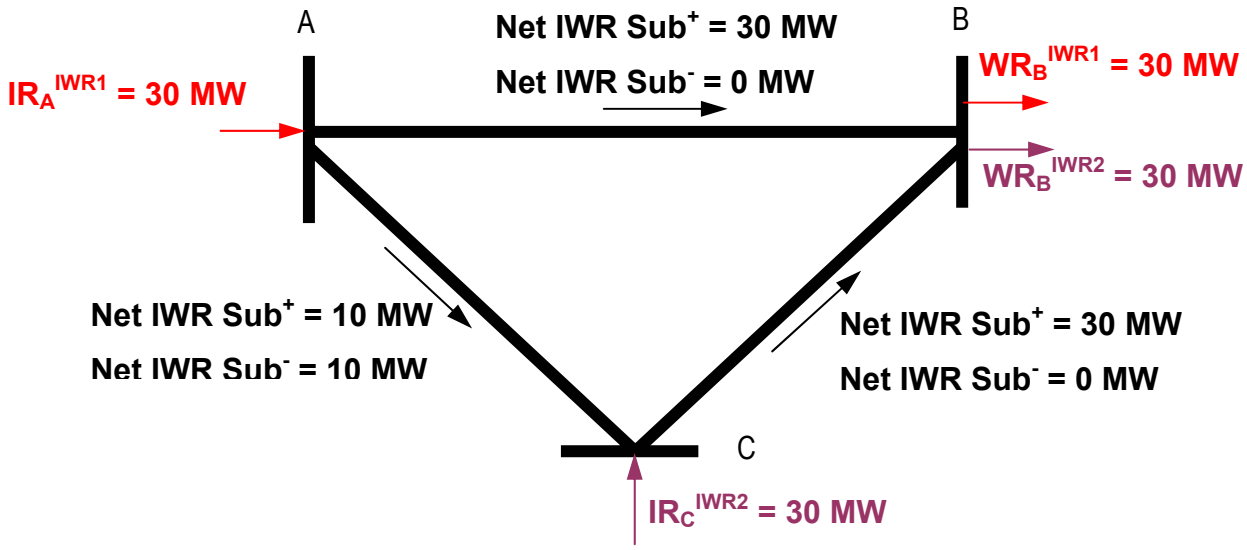

Figure Ac - IWR Flowgate Subscriptions

Table Ab - AFC after accounting for IWRs

Flowgate	AFC+ before IWRs	AFC- before IWRs	Net IWR Sub+	Net IWR Sub-	AFC+ after IWRs	AFC- after IWRs
A - B	30 MW	90 MW	30 MW	0 MW	0 MW	90 MW
A - C	81 MW	120 MW	10 MW	10 MW	71 MW	110 MW
C - B	81 MW	120 MW	30 MW	0 MW	51 MW	120 MW

Table A-c - PUFs for the example system (Bus C is the Reference/Slack Bus)

Flowgate	Bus A	Bus B	Bus C
A - B	1/3	-1/3	0
A - C	2/3	1/3	0
C - B	-1/3	-2/3	0

In Table A-c PUFs represent the flow contribution on a flowgate due to injection of 1 MW at a bus. For example, this table shows that if 1 MW is injected at Bus B, 1/3 of a MW will flow on Flowgate A-B in the opposite direction (from B to A), 1/3 MW will flow on Flowgate A-C and 2/3 MW will flow on Flowgate C-B in the opposite direction (from B to C) - please note that Bus C is the reference bus, i.e. every MW injected at Bus B ends up at Bus C. Table A-c helps with

predicting flow contribution due to an IWR. Suppose a Transmission Customer wants to buy 30 MW IWR from Bus A to Bus B. This participant calculates its contribution on every flowgate as follows:

- Flowgate A-B: 30 * [(1/3) - (-1/3)] = 20 MW
- Flowgate A-C: 30 * [(2/3) - (1/3)] = 10 MW
- Flowgate C-B: 30 * [(-1/3) - (-2/3)] = 10 MW

Auction Example 1:

Entering into the auction we assume that that there are two bidders for IWRs in the IWR auction:

- Bid1: 50 MW from bus A to bus B at $20/MW
- Bid2: 50 MW from bus C to bus B at $15/MW

Let's also assume that the owner of IWR1 offers the IWR as follows:

- IWR1 offer: 15 MW IWR as price taker

Figure A-d presents the network diagram for this bidding scenario. Please note that the arrows for the offered IWRs are reversed to show that they are offered for sale to free up capacity for new IWR buy bids. Also note that AFCs from the last round are included on the diagram.

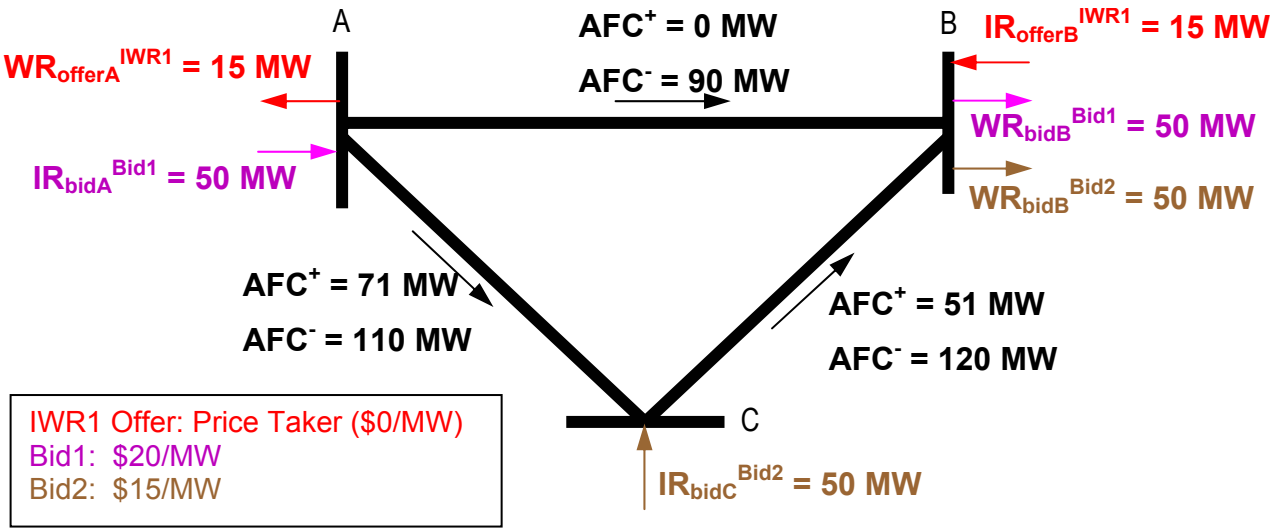

Figure A-d - IWR Auction Offers and Bids

Figure A-e presents the IWR auction results. The auction outcome has been attained based on maximizing the overall value of the IWR trades (total value of the bids minus the total cost of offers) which awards the offered IWRs to Bidder 2, even though Bidder 2 bid a lower per MW

price, since for every one MW of IWR1 offered, Bidder 2 can buy two MWs due to network configuration. For this auction award, the overall market value is:[38]

- 30 MW * $15/MW - 15 MW * $0/MW = $450

If Bidder 1 was selected, the overall market value would have only been:

- 15 MW * $20/MW - 15 MW * $0/MW = $300

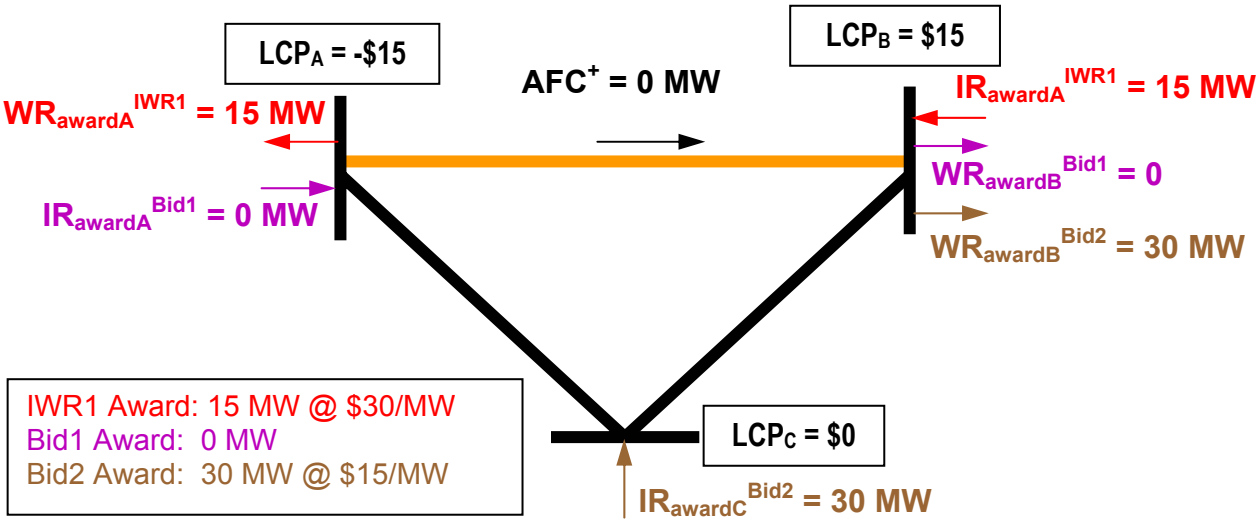

Figure A-e - IWR Auction Results

In this example Bid2 is at margin and sets clearing prices at all buses. Please note that the negative clearing price at Bus A is a result of setting the reference price bus at zero. The negative price does not signify anything in an IWR auction, as only the differences in bus clearing prices are meaningful in such an auction.

Table A-d presents the settlement amounts. Please note that in this scenario although the value trades is $450, Grid West will be revenue neutral (difference of the awarded IWR charges and awarded IWR credits).

Table A-d - IWR auction awards and settlement results

Participant	Award Amount	IWR Price	Charge or (Credit)
IWR1	15 MW	$30/MW	($450)
Bidder 1	0	0	0
Bidder 2	30 MW	$15/MW	$450

[38] Note that market value calculation and actual settlements calculations are two completely separate processes. Auction value simply determines who is awarded in the auction based on their offer and bid prices.

Auction Example 2:

In this example let's assume that the owner of IWR2 offers the IWR as follows:

- IWR1 offer: 30 MW IWR as price taker

Figure A-f presents the network diagram for this bidding scenario.

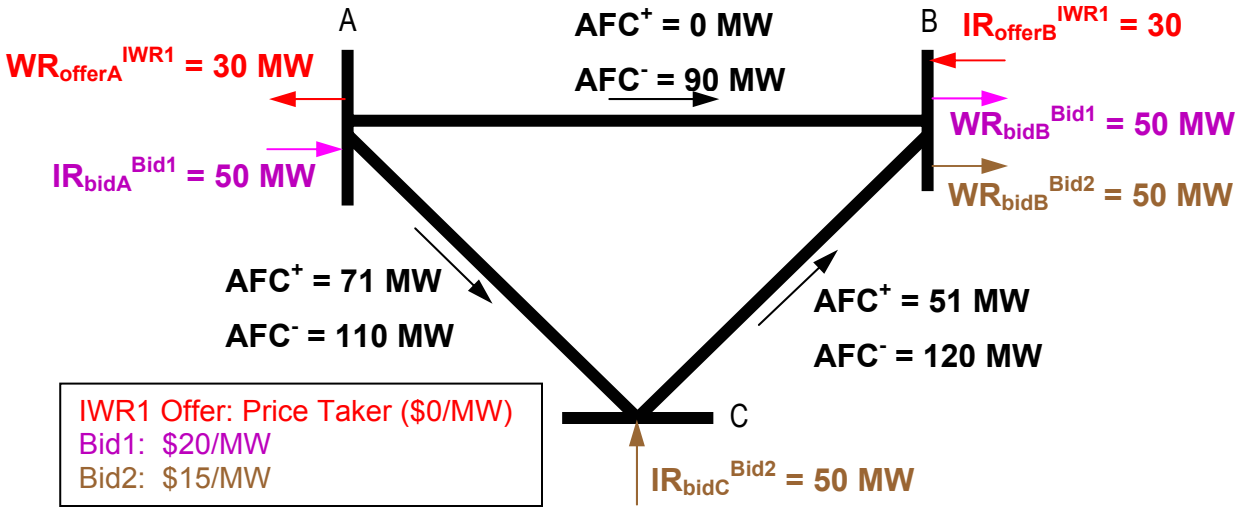

Figure A-f - IWR Auction Offers and Bids

Figure A-g presents the IWR auction results. The auction outcome has been attained based on maximizing the overall value of the IWR trades (total value of the bids minus the total cost of offers). In this example Bid1 is at margin and sets the clearing prices at all buses.

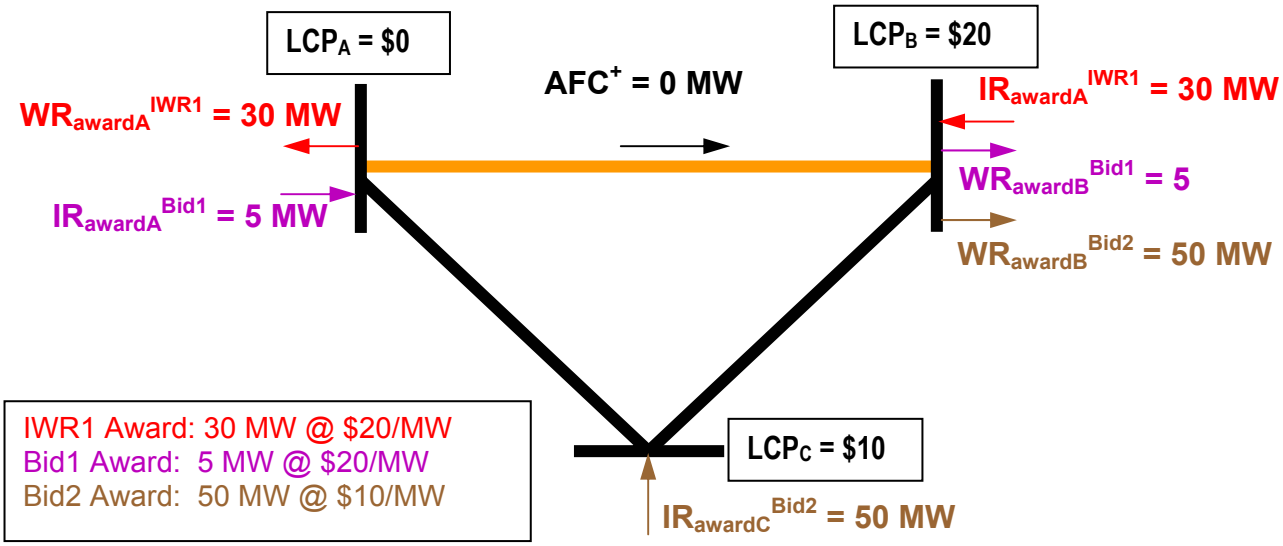

Figure A-g - IWR Auction Results

Table A-e presents the settlement results for this example.

Table A-e - IWR auction awards and settlement results

Participant	Award Amount	IWR Price	Charge or (Credit)
IWR1	30 MW	$20/MW	($600)
Bidder 1	5 MW	$20/MW	$100
Bidder 2	50 MW	$10/MW	$500

Appendix B - EXAMPLE OF DA-RCS

In this appendix we will present a simple end-to-end example that covers the principal functions of the DA-RCS process. As noted earlier the many of the steps in DA-RCS process are distinct from those of other RCS processes.

Pre-Auction:

Figure B-a shows a three-bus system that will be used to present the example of DA-RCS. Total Flowgate Capacities (TFCs) are also shown in this figure.

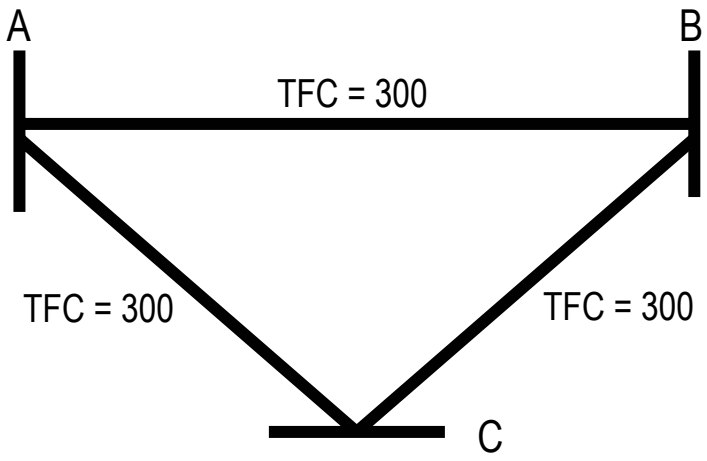

Figure B-a - Transmission Rights Basecase

Let's assume that these is one multipoint-to-multipoint ETR, with existing scheduling flexibility (ESF) as shown, and one IWR in this system - Figure B-b:

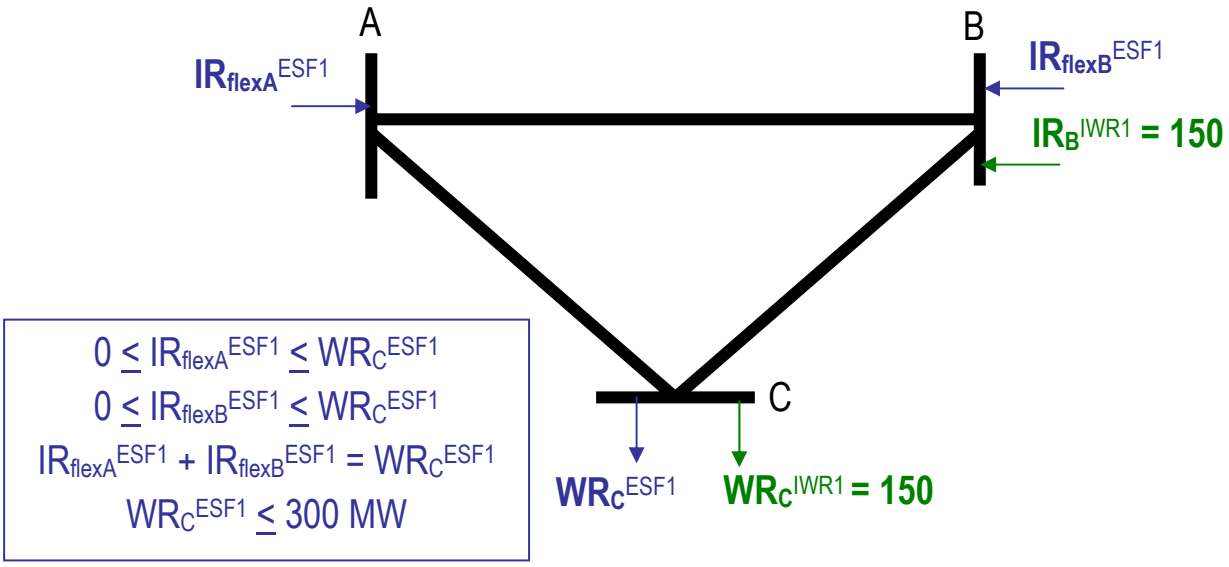

Figure B-a - Existing Rights Configuration

Table B-a presents the process of calculating AFCs for DA-RCS. As described in Section 4.6, for DA-RCS:

- The entire scheduling flexibility is taken into consideration in evaluating flowgate subscription due to an ESFs;
- Counterflows due to ETRs and IWRs are allowed; and
- AFCs are modified based on X-factors after subscriptions are netted out.

Table B-a - AFC calculation for DA-RCS

Flowgate	TFC (MW)	Net Sub by ESF/IWR (MW)		AFC Before X (MW)		X-factor	AFC after X (MW)	
		+	-	+	-		+	-
A-B	300	50	-50	250	300	0.9	225	270
A-C	300	250	0	50	300	1.0	50	300
B-C	300	300	0	0	300	1.0	**Zero(0)**	300

Note that based on this right configuration, there is no AFC on flowgate B-C from B to C; hence, no new rights can be awarded (issued) based on AFCs in the system.

Auction:

Entering into the DA-RCS auction, we assume that the ESF holder offers to release its flexibility as a price taker and IWR2 is a new bid to buy capacity as shown in Figure B-b below. In this figure ESF holder submits an intended retained right configuration will less flexibility than the original right allowed and as such releases the extra flexibility into DA-RCS auction. IWR1 maintains its position unchanged.

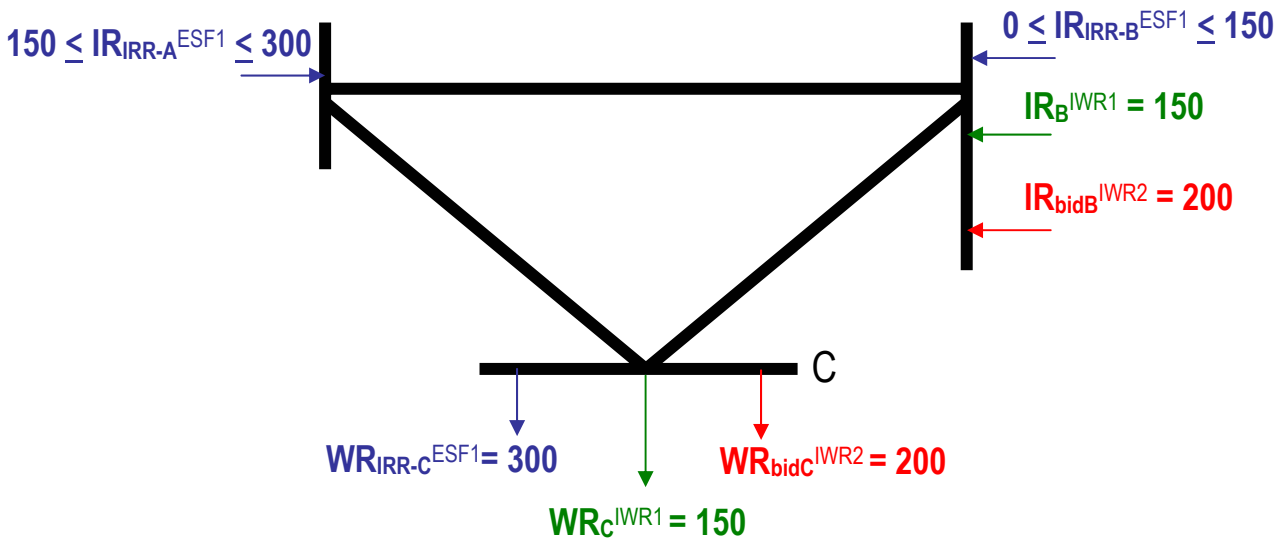

Figure B-b - DA-RCS IWR Auction Offers and Bids

Table B-b presents the AFCs before the auction and after ESF1 holder has offered some of its flexibility.

Table B-b - AFCs after ESF1 holder offered some of its flexibility

Flowgate	TFC (MW)	Net Sub by ESF/IWR (MW)		AFC Before X (MW)		X-factor	AFC after X (MW)	
		+	-	+	-		+	-
A-B	300	50	50	250	250	0.9	225	225
A-C	300	250	0	50	300	1.0	50	300
B-C	300	250	0	50	300	1.0	**50**	300

Note that due to ESF1 flexibility offer, Flowgate B-C's AFC increases from zero to 50 MW. During the auction this 50 MW AFC is used to award 75 MW to IWR2 as shown in Figure B-c, which contains the auction outcome.

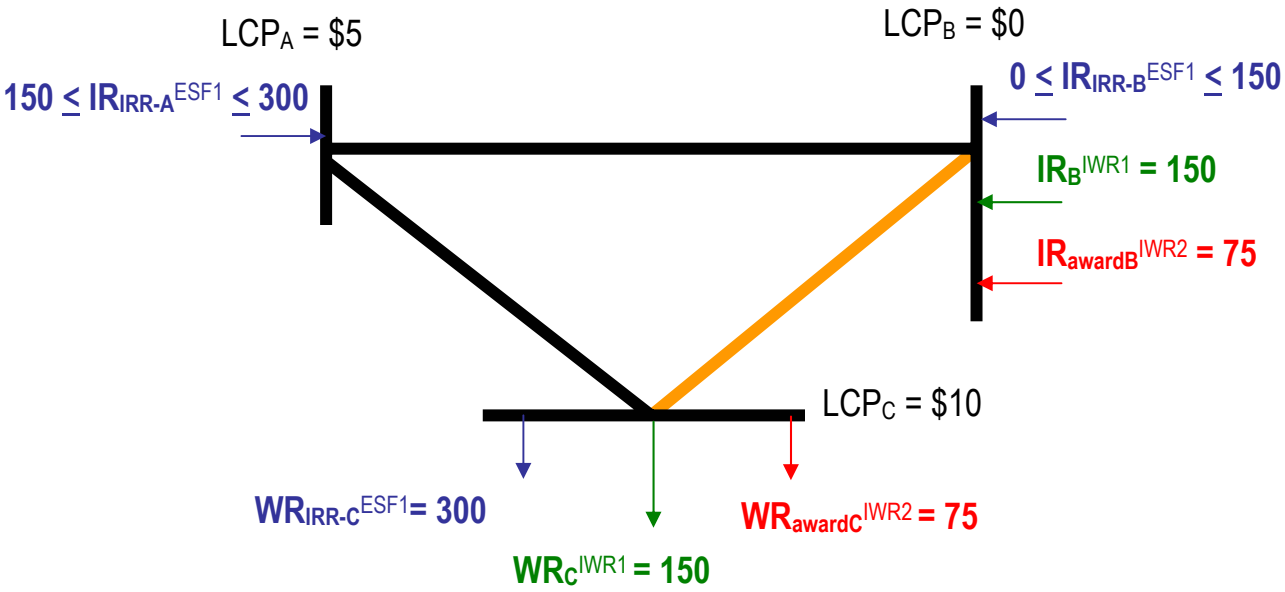

Figure B-c - IWR Auction Results

In this example IWR2 is at margin and sets clearing prices at all buses.

The settlement results are presented in the following:

- IWR2 pays: 75 * ($10 - $0) = $750
- ESF1 receives: 50 * $15 = $750

Note that ESF1 holder is paid based on the value of the 50MW AFC that it has released into DA-RCS - product of released AFC on B-C flowgate (50 MW) and the shadow price of that flowgate ($15/MW).

Appendix C – AN INTRODUCTIOIN TO THE CALCULATION OF POWER FLOWS FOR THE NON-TECHNICAL READER

In the examples given in Appendices A and B, simple three-bus (node) networks are used. The Appendix demonstrates how the power flows may be calculated for these simple networks. This material is provided to assist non-technical readers of the white paper in understanding the flow shown in the examples for various injections and withdrawals.

In an electrical network, the flow on any given line, due to the injection of power at one point and a matching withdrawal of power at another point, is based on that given line's relative impedance[39] compared to the impedance of other lines. The simplest case for illustrating this principle is shown in Figure C-a, which has only two buses A and C and two parallel lines between these buses. The impedance of Line 2 is twice that of Line 1, so Line 1 will carry twice the power flow of Line 2.[40]

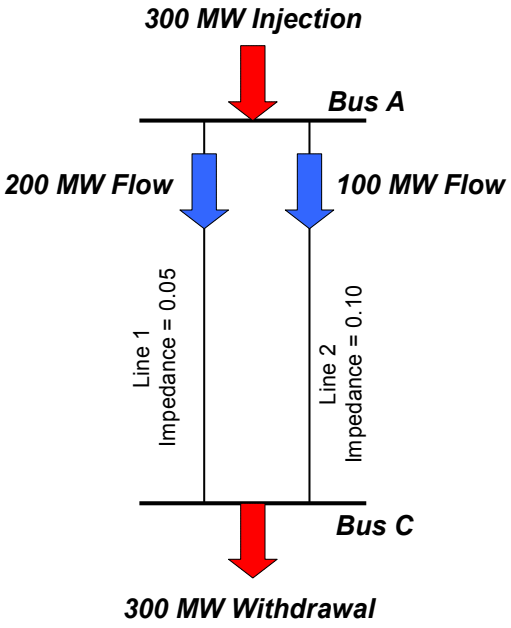

Figure C-a – A Two Bus Model

[39] Impedance is a general term used to describe the opposition of a line operating in an AC network to a change in power flow.

[40] Based on laws of physics, also known as the Ohms Law, lower impedance for a line means that more power flow will go through that line with the magnitude of the flow proportional to the inverse of the impedance. This is analogous to having a pair of pipes connected to a common water source with one pipe having twice the cross sectional area of the other pipe. In this water analogy, the larger pipe has the half the impedance of the other pipe and therefore admits twice as much water. Path Utilization Factors (PUFs) essentially give the same information. They show how an injection at a bus will flow on a line based on the impedance of that line compared to impedances of all lines in the system.

If we take Line 2, cut it in half and add another bus B at the cut and then reconnect the system, the result in shown in Figure C-b.

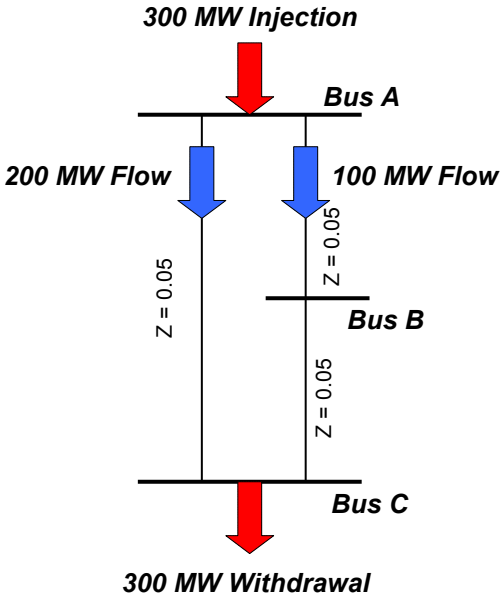

Figure C-b – Adding Another Bus

What was Line 2 in Figure C-a is now divided into Lines A-B and B-C, while Line 1 is now called Line A-C. The impedance (Z) of each of the lines is shown in Figure C-b. Line A-B and Line B-C each have half of the impedance of Line 2 since they are each one half of that line. Because these two line segments are in series with each other, line impedances add together to give the resultant impedance for the combination of lines A-B and B-C. The resulting relative impedance of Line A-C to the rest of the system is unchanged, so the distribution of power flows is unchanged. Note that with the addition of Bus B, all the line segments have the same impedance, Z = 0.05. We can redraw the diagram as shown in Figure C-c.

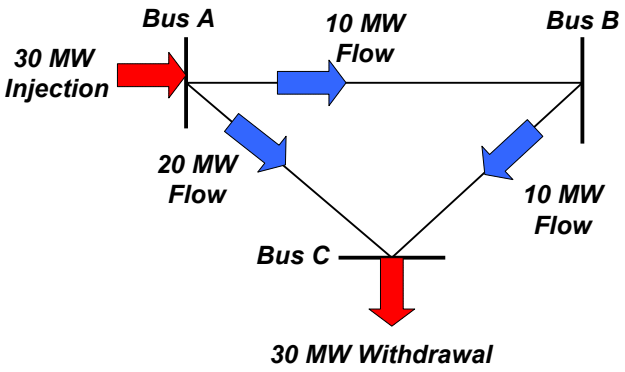

Figure C-c – A Three Bus Model

Although the impedances are no longer shown in Figure C-c, they remain the same for each segment, i.e., Z = 0.05. The flows are unchanged, only the shape of the drawing is changed. Figure C-c is now in the form used for all the three bus models in Appendices A and B above, with equal impedance in each line segment. Now suppose that instead of injecting power at Bus A, we decide to inject power at Bus B instead and at the same time change the injection to 60 MW. The result is shown in Figure C-d.

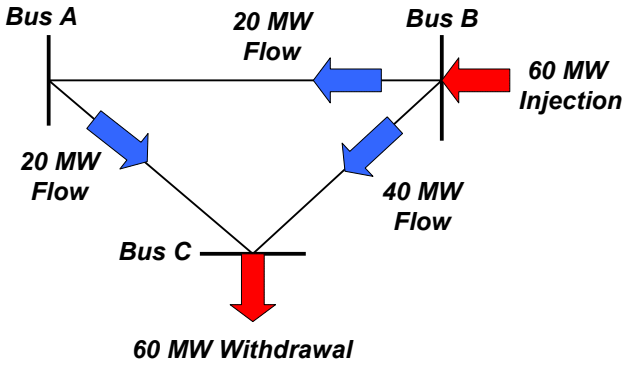

Figure C-d – Changing the Injections and Withdrawals

Again the impedance of the lines from B-A and A-C add together to give Z = 0.10, or twice the impedance of line B-C. The result will be twice as much flow on line B-C, so again the flows split on a one-third to two-thirds basis, with 40 MW on the line with lower impedance and 20 MW on the other line.

Now suppose you want to add both transactions at the same time – that is transfer 30 MW from Bus A to Bus C and 60 MW from Bus B to Bus C - equivalent to 30 injection at Bus A, 60 MW injection at Bus B and a 90 MW withdrawal at Bus C. For simple models like those used for this paper's illustrations, the principle of superposition applies – that is the solution show in

Figure C-c and Figures C-d can be “superimposed” on each other oradded together to get a net result.

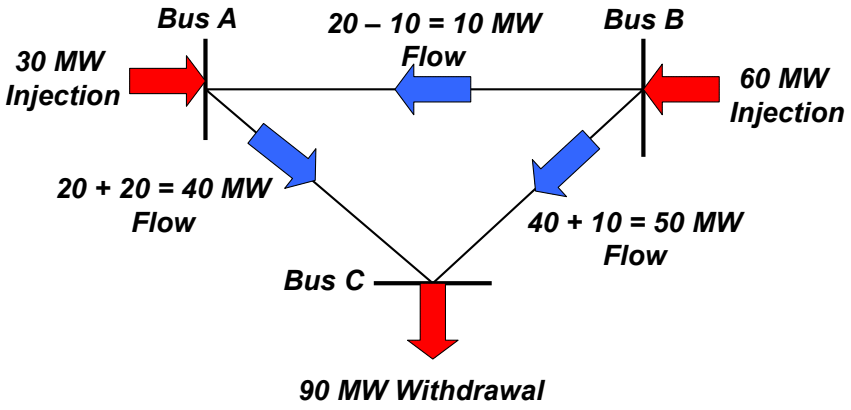

Figure C-e – Multiple Injections at Different Buses

The additive nature of the flows is shown in Figure C-e above on lines A-C and B-C. For instance, the flow on line B-C in Figure C-c was 40 MW for 60 MW injected at B and withdrawn at C. The flow on line B-C was 10 MW for the 30 MW injected at Bus A and withdrawn at Bus C. Because we can add the two individual cases, we get 40 + 10 = 50 MW for the combined case. The use of the superposition principle allows the solution of simpler problems that can then be added together to get to the net result.[41]

Another important principle is show in Figure C-e, namely, that all the flows into and out of any given bus must be zero. For instance at Bus A, there is a net 10 MW flowing in from Bus B, 30 MW is injected by generation, so 40 MW flows out toward Bus C. If we give a negative sign to out flow, then 10 + 30 – 40 = 0.

In the illustrations of the principles of transmission right reconfiguration in Appendices A and B, the injection and withdrawal rights are treated as physical injections and flow result can be computed as show above. Because the impedances are equal for all the line segments in the papers examples, one thirdof an injection will take the “long route” and two thirdswill take the “short route” for the reasons described above.

[41] The assumption of linearity for an AC network is reasonable for normal operating conditions.

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1.0 EXECUTIVE SUMMARY AND CONCLUSIONS

The proposed design for Grid West services emphasizes physical power transactions among its Transmission Customers by making transmission capacity available to Grid West Transmission Customers. The Transmission Service Liaison Group (TSLG) has focused on developing processes to maximize access to the Grid West Managed Transmission System (GWMT) through the acquisition of transmission rights. The Reconfiguration Service (RCS) has been proposed to serve this purpose. Specifically, the RCS makes transmission capacity available through: a) existing Available Flow Capacity (AFC); b) voluntary resale of existing transmission rights; and c) the voluntary sale of existing scheduling flexibility.[1]

A Redispatch Service (RDS) was included in the Regional Proposal[2] as a basic feature of Grid West. The purpose of RDS was to enable greater use of the transmission system by obtaining advanced scheduling commitments. During the initial design work (Layer 1), difficulties were encountered in attempting to design the RDS. Two primary difficulties were identified, appearing to have the potential for creating severe market gaming opportunities.[3]

- First, since participation in RDS would be voluntary, only some schedules would be (financially) constrained by the day-ahead redispatch. However, because not all parties would be constrained to a day-ahead schedule, the congestion optimization achieved by the day-ahead redispatch could be undone by parties who retain and use their pre-existing scheduling flexibility after the day-ahead process ends.
- Second, measurement of performance would be problematic. A voluntary day-ahead redispatch is a partial energy market. Deviations from day-ahead energy schedules must be settled against real-time energy

[1] Given the differently situated regulatory regime in Canada and British Columbia, in particular, the operating assumption is that the Grid West market design will be mirrored in British Columbia, to the extent possible within that regulatory regime. Details regarding the market design in British Columbia are anticipated to be completed as part of detailed design phase of this effort.

[2] "Narrative Description of RRG Platform Group Regional Proposal", December 24, 2003, pp. 7-8, http://gridwest.org/Doc/FinalNarrative_RegionalProposal_Dec242003.pdf. The Regional Proposal described an Independent Entity (IE) that has since been given the name Grid West.

[3] This type of bilateral transmission trade facilitates the surplus power market, especially in the shorter term. Older transmission instruments still in place, and older transmission contracts offered by the Transmission Owners are typically not tradable on the secondary market as there are no resale rights associated with these contracts.

deliveries. However, since not all participants in the day-ahead redispatch would be subject to a single set of prices of real-time balancing energy prices, how would reconciliation occur? Some parties would be in the CCA where a set of consistent real-time clearing prices would apply, while prices outside the CCA would have to be based on OATT tariff concepts or some other price indicators.

When the day-ahead redispatch issue was revisited by TSLG at the start of the next phase of design (Layer 2), RCS was better understood than during the Layer 1 discussion of RDS. In reviewing the intended purposes of the RDS, it became clear that one of the desired effects (getting parties to release a portion of their scheduling flexibility, i.e. commit to a generation plan day-ahead) could be accomplished through the Day Ahead Reconfiguration Service (DA-RCS). If parties with scheduling flexibilities (generation operators, transmission rights holders with various delivery points, etc.) could limit or give up their scheduling flexibility in DA-RCS, the "headspace"[4] set aside to preserve pre-existing rights would be reduced. That reduced "headspace" becomes AFC that can be sold as Injection-Withdrawal Rights (IWRs) in DA-RCS. Thus, by enhancing the DA-RCS to handle releases of scheduling flexibility, Grid West would realize a major portion of the RDS benefit while avoiding many of the RDS complications mentioned above. In other words, through this proposal, DA-RCS achieves an important RDS objective, namely making more transmission system capacity available through voluntary offers to restrict changes in generation for the following day.

With this modification, the typical day for pre-scheduling in Grid West fits easily into the general pattern of pre-scheduling used today. Trades for the next day occur very early in the morning followed by calls to various transmission providers to find out if transmission can be found to execute the trades. With this done, pre-schedules are submitted to the transmission providers. The DA-RCS replaces the calls to find transmission with a central auction where AFC is more readily available through a single centralized process that includes pre-release AFC, AFC made available by IWR releases, and AFC freed up by releases of scheduling flexibility.

[4] Headspace is a term used to describe the capacity set aside prior to an RCS auction to preserve pre-existing rights, including the scheduling flexibility (or optionality) of generators and transmission rights holders to change their schedules after the close of the day-ahead scheduling process.

1.0 EXECUTIVE SUMMARY

Grid West Basic Features should not adversely impact existing bilateral trading practices within the Grid West Managed Transmission (GWMT) system.[1]

2.0 BACKGROUND

Bilateral trading refers to transactions not administered by Grid West in which wholesale energy, transmission rights and reserves are directly traded among Grid West Transmission Customers. Parties in the GWMT engage in a variety of bilateral trades of wholesale energy, transmission rights and reserves. Energy is typically sold for forward quarters, months, balance of the month, daily, and the period between close of pre-schedule and hour of delivery. These trades are important to improve the efficiency of the overall power market and provide the primary opportunity for parties who are either long or short to balance their positions on a forward basis.

Bilateral secondary transmission trades occur most frequently on BPA's system. Point-To-Point (PTP) capacity is sold bilaterally in several ways:

- Non-firm blind assignments
- Firm assignments
- Firm redirects

These trades are ways for holders of PTP to recoup some of their sunk PTP costs and are typically sold at a discount from the originally posted price. For secondary buyers, these trades are often available when there is no Available Transmission Capacity (ATC) on a transmission provider's system, where they are less expensive than buying the capacity directly from the provider, and when they are easier to transact than going to the transmission provider's Open Access Sametime Information System (OASIS). This type of bilateral transmission trade facilitates the surplus power market, especially in the shorter term. Older transmission instruments still in place (such as BPA's Integrated Resource Transmission Service and Formula Power Transmission Service, and older transmission contracts offered by the Transmission Owners are typically not tradable on the secondary market as there are no resale rights associated with these contracts. The formation of Grid West should not hinder the existing bilateral market for power and transmission.

[1] Given the differently situated regulatory regime in Canada and British Columbia, in particular, the operating assumption is that the Grid West market design will be mirrored in British Columbia, to the extent possible within that regulatory regime. Details regarding the market design in British Columbia are anticipated to be completed as part of detailed design phase of this effort.

Grid West will centrally administer Available Flowgate Capacity (AFC), so Transmission Owners will no longer issue new transmission rights. Load Serving Entities will continue to have the option to procure the necessary long-term transmission to move energy and related commodities from long-term resources to their load centers. Bilateral trading of existing rights will continue to be possible under Grid West to the extent allowed under relevant contracts.

3.0 PURPOSE

The purpose of this paper is to qualitatively analyze the impact of Grid West services on bilateral trading activities within the GWMT.[2]

4.0 IMPACT OF GRID WEST SERVICES ON BILATERAL MARKETS

The following Grid West services were evaluated:

- Long-term regional expansion planning service
- Transmission access administration
- Reconfiguration service
- Regional scheduling service
- CCA Real-time balancing service
- CCA Reserve market

Grid West Basic Features should not adversely impact existing bilateral trading within Grid West, but should enhance such trading activities by offering price transparency and other mechanisms encouraging such trades to take place.[3] Grid West will administer Available Flowgate Capacity (AFC), so Transmission Owners will no longer issue new transmission rights. Bilateral trading of existing rights will continue under Grid West to the extent allowed under relevant contracts. Participants may find it easier, and potentially more beneficial, to translate such rights into IWRs before trading them either bilaterally or in centrally administered markets.

[2] In this white paper we focus on economic and technical dimensions of bilateral trading practices and will not address the regulatory jurisdiction and rules that govern bilateral trading within the GWMT and whether or how these regulatory factors will play any role in the evolution of these markets.
[3] This is also in line with the general understanding that all factors that fundamentally discourage centralized administered markets can also discourage bilateral markets and vice versa.

4.1 Wholesale Energy

Grid West will introduce a number of centrally administered markets and services to facilitate the trading of wholesale energy, transmission rights and reserves. These markets should help promote bilateral trading within Grid West through the production of stable reference prices.[4] Grid West's centrally administered markets will produce such reference prices if they are sufficiently liquid. Table 4.1 qualitatively analyzes the impact of Grid West Basic Features on bilateral trading.

Table 4.1 - Impact of Grid West on Bilateral Wholesale Energy Trading

Grid West Service	Impact on Bilateral Wholesale Energy Trading
Regional Planning & Capacity Expansion Service	Grid West will provide a transmission and capacity expansion service[5]. Projects proposed by Transmission Owners or other Transmission Customers will be evaluated considering the needs of the entire GWMT. The completion of expansion projects will allow for more energy transactions between energy suppliers and customers. Regional capacity planning and capacity expansion service by Grid West is expected to facilitate the development of new energy resources that in turn should promote additional bilateral trading of wholesale energy.
Transmission Access Administration	Grid West will administer transmission access, making it easier for new and existing energy resources to reach energy customers across the entire GWMT and enhancing the volume of bilateral wholesale energy trades.[6]
Reconfiguration Service (RCS)	Reconfiguration services provide wholesale energy traders with additional transmission information (e.g., reference prices), and the additional and standardized means (IWRs) to acquire long-term and short-term transmission rights to be used for bilateral wholesale energy trading. Voluntary release of scheduling flexibility as part of D-

[4] There are numerous examples of how reliable reference prices for any commodity have led to a rapid rise in the volume of bilateral (whether OTC or exchange facilitated) trading of that commodity - please see http://www.nordpool.com for the example of energy trading growth.
[5] See the accompanying Grid West White Paper on Regional Planning and Capacity Expansion service - to be released.
[6] It is understood that access will only be granted with due consideration for all relevant reliability requirements for GWT, studied jointly by Grid West and PTOs, including determination of all the necessary system upgrades to deal with such reliability requirements.

	RCS will free up additional transmission capacity just before the DA scheduling process and allow Grid West Transmission Customers to acquire additional IWRs to facilitate additional bilateral whole energy transactions.
Region-wide Scheduling Service	Region-wide scheduling services, including the operation of a public market information site (e.g., OASIS), provide Transmission Customers with valuable information about transmission availability, resulting in better regional coordination of transmission resources. This should further facilitate the bilateral trading of wholesale energy.
CCA Real-time Balancing Service (RBS)	RBS provides another forum for bilaterally traded wholesale energy to be sold, and hence, Grid West's RBS should enhance bilateral trading of wholesale energy.
CCA Reserve Market Service	The reserve market should have neither a negative impact nor an identifiable positive impact on bilateral wholesale energy trading.

4.2 Transmission Rights

Grid West will issue standardized tradable instruments (IWRs) used in both central and bilateral markets for trading transmission rights. These new products and the development of reference prices (and price discovery) should positively impact the bilateral trading of transmission rights. Table 4.2 is intended to qualitatively analyze the impact of Grid West Basic Features on bilateral transmission rights trading within Grid West.

Table 4.2 - Impact of Grid West on Bilateral Transmission Rights Trading

Grid West Service	Impact on Bilateral Transmission Rights Trading
Regional Planning & Capacity Expansion Service	Grid West issues transmission rights created by new transmission projects as IWRs.[7] Thus, new transmission projects make additional IWRs available for both RCS and bilateral markets to trade. Grid West centrally administers long-term requests for AFC, with rights issued as IWRs.
Transmission Access Administration	Administration of transmission access by Grid West should make it easier to access the transmission system on a regional basis. As a result, it is expected to increase the demand for transmission rights (IWRs), which in turn

[7] The process of translating new transmission projects into IWR will also involve PTOs and WECC and is presented in the accompanying on rights data management.

	should increase the volume of transmission rights trades both in bilateral and centrally administered markets.
Reconfiguration Service (RCS)	Creation of readily tradable instruments and contracts for transmission rights (IWRs) will allow bilateral trading of transmission rights to be more easily managed in the Over the Counter (OTC) and exchange-based markets, likely leading to increased bilaterally traded transmission rights (IWRs). Reconfiguration service along with RDS creates reliable reference prices (and price discovery) for IWRs, which are expected to also promote bilateral markets for transmission rights (IWRs). Reconfiguration service allows IWRs acquired through various mechanisms such as bilateral trades to be centrally auctioned, or vice versa. Hence, RCS is expected to enhance bilateral trading of transmission rights (IWRs). Short-term use of AFC is centrally administered by Grid West with the Reconfiguration Service enabling transmission users to combine AFC with releases enabled translation of existing rights and the reconfiguration auctions. Direct requests for AFC from Transmission Owners will not be possible once Grid West takes over capacity management of transmission facilities. Voluntary release of scheduling flexibility as part of D-RCS will free up additional transmission capacity just before the DA scheduling process and allow Grid West Transmission Customers to acquire additional IWRs. These IWRs may be bilaterally traded between D-DCS and the deadline of IWR registration with Grid West.
Region-wide Scheduling Service	Region-wide scheduling services, including the operation of a public market information site (e.g., OASIS), provides Transmission Customers with valuable information about transmission availability resulting in better regional coordination of transmission resources. These outcomes should further facilitate the bilateral trading of transmission rights.
CCA Real-time (RT) Market Operations	No impact.
CCA Reserve Market Operations	Participants located outside the CCA who wish to participate in the CCA Reserve Market may need to acquire the appropriate transmission rights if they wish to offer resources into a reserve zone in which they are not located. This should promote bilateral trading of

	transmission rights.

4.3 Reserves

Grid West services, specifically the CCA reserve auction market, should enhance bilateral reserve markets within Grid West. Table 4.3 qualitatively analyzes the impact of Grid West Basic Features on the bilateral trading of reserves within Grid West.

Table 4.3 - Impact of Grid West on Bilateral Reserve Trading

Grid West Service	Impact on Bilateral Reserve Trading
Regional Planning & Capacity Expansion Service	No significant direct impacts on bilateral reserve trading are expected here. Secondary impacts can be observed due to additional and accelerated development of new energy resources brought about due to long-term regional expansion planning service of Grid West.
Transmission Access Administration	Resources out of the CCA can access transmission system in a more straightforward manner due to transmission access administration by Grid West and, hence, should be able to bilaterally offer their reserve capacity to CCA utilities when transmission is required.
Reconfiguration Service (RCS)	Reconfiguration service should allow resources outside CCA to acquire IWRs giving them the ability to bilaterally offer their reserve capacity to CCA utilities (when transmission is required).
Redispatch Service (RDS), if and when implemented	Redispatch service should not directly impact bilateral reserve trading within GWMT.
Region-wide Scheduling Service	Region-wide scheduling services, including the operation of a public market information site (e.g., OASIS), provides valuable information about reserve requirements and transmission availability to all Grid West Transmission Customers (and beyond) resulting in better coordination of reserve acquisition and transmission resources use on a regional level. These outcomes are expected to further facilitate the bilateral trading of reserves.
CCA Real-time (RT) Market Operations	CCA RT market operation is not expected to directly impact bilateral reserve trading within GWMT.
CCA Reserve Market Operations	The CCA reserve market should significantly increase bilateral trading of reserve products. A potential CCA limited must offer reserve obligation would directly

	promote bilateral trading of reserves as Grid West Transmission Customers who are short on reserve capacity will seek to contract for such reserves bilaterally in order to satisfy their obligations.

5.0 PARTICIPATION IN BILATERAL TRADING AND ROLES & RESPONSIBILITIES

Table 5.1 presents the three bilateral trading activities that are expected within the GWMT and the roles that various Grid West Transmission Customers directly play in each of these activities.

Table 5.1 - Grid West Transmission Customer's Role in Bilateral Trading

Bilateral Markets	Grid West	Transmission Owners	Transmission Customers
Bilateral Wholesale Energy Trading	▪ None	▪ None	▪ Buy/sell wholesale energy bilaterally
Bilateral Transmission Rights Trading	▪ Register and confirm bilaterally traded IWRs	▪ None for IWRs. ▪ ETRs reassignments, if requested under original contract or tariff provisions, may require TO involvement.	▪ Buy/sell transmission rights bilaterally
Bilateral Reserve Trading	▪ None	▪ None.	▪ Buy/sell reserve bilaterally

6.0 MARKET BENCHMARKS

Except for the recent credit problems that have resulted in migration of bilateral energy trading volumes into the RTO/ISO administered markets, bilateral markets are functioning within existing RTOs and ISOs. Table 6.1 provides benchmarks of existing RTO/ISO bilateral markets.

Table 6.1 - Bilateral Trading Benchmarks

Timing	PJM	ERCOT	MISO
Bilateral Wholesale Energy Trading	▪ Bilateral energy trading increased in PJM after PJM launched its markets and published reference prices for	▪ Since ERCOT has opened its market for retail competition and because ERCOT does not have a Day-Ahead energy market, the volume of bilateral	▪ No relevant experience for MISO yet.

	energy at its major hubs. ▪ Recent dips in these bilateral energy market volumes in favor of increase in the volume of PJM markets reflect credit concerns in the bilateral markets.	energy trading in ERCOT has increased significantly since the operation of ERCOT ISO started. ▪ Recent dips in these bilateral energy market volumes in favor of the ERCOT RT market reflect credit concerns in the bilateral markets.	
Bilateral Transmission Rights Trading	▪ Bilateral trading of transmission rights in PJM, ERCOT and MISO is limited to standardized financial transmission rights (FTRs for PJM and MISO and TCRs for ERCOT). Existing rights cannot be bilaterally traded. Grid West will continue to allow bilateral trading of existing rights when allowed in relevant contracts. ▪ Compared to existing RTOs and ISOs, Grid West has a unique requirement that scheduling can only be done consistent with relevant physical transmission rights. This requirement is expected to make overall (including bilateral) trading of transmission rights significantly more active within GWMT compared to existing RTOs.		
Bilateral Reserve Trading	▪ PJM and ERCOT allow self-scheduling of reserves, which has contributed to a healthy bilateral market for reserves in their footprints. Grid West CCA's potential limited must offer obligation for reserves is expected to achieve the same outcome.		▪ No relevant experience for MISO yet.

1.0 EXECUTIVE SUMMARY

As envisioned in the Regional Representative Group's (RRG) regional proposal, Grid West will act as the central scheduling authority for the Grid West Managed Transmission System (GWMT). As the central scheduling authority, Grid West will implement a flow-based physical scheduling process. This process requires all Grid West Transmission Customers to possess the proper physical transmission rights prior to scheduling in the day ahead period. Physical rights may be in the form of existing transmission rights (ETRs) or Grid West-issued Injection Withdrawal Rights (IWRs). Grid West will manage these physical rights through three distinct processes:

- ***Physical Rights Inventorying***: Compilation of Transmission Owner rights obligations (TO obligations)
- ***ETR Certification***: Certification of Transmission Customer's existing transmission rights when requested by these customers
- ***IWR Translation Query***: Voluntary request for information regarding the translated value of a Transmission Customers' ETRs in terms of IWRs
- ***Bilateral Trade Registration***: Registration of IWR trades in the secondary market

Collectively, these processes are referred to as Rights Data Management (RDM).[1]

2.0 PURPOSE

The purpose of this white paper is to review the proposed Rights Data Management design, including Rights Inventorying, Rights Certification, Rights Translation Query, and Bilateral Trade Registration processes.

3.0 BACKGROUND

Currently, no single entity has a regional view of the Northwest transmission system prior to real-time.[2] The region's transmission capacity is managed

[1] Given the differently situated regulatory regime in Canada and British Columbia, in particular, the operating assumption is that the Grid West market design will be mirrored in British Columbia, to the extent possible within that regulatory regime. Details regarding the market design in British Columbia are anticipated to be completed as part of detailed design phase of this effort.

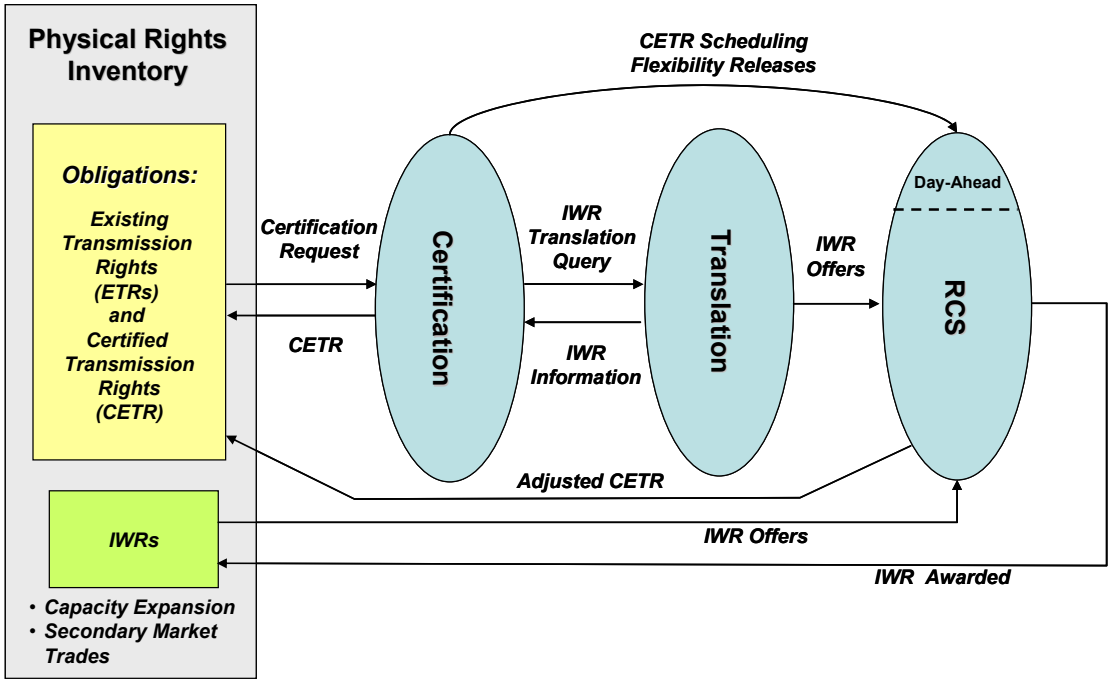
principally on a "contract path" basis by 17 individual control areas. Finally, the current contract path methodology does not match the physical operation of the transmission grid. In addition, each Transmission Operator determines its available transmission capacity based upon its own criteria.

As a part of its Basic Features, Grid West will centrally manage all scheduling activities within the GWMT. In this role, Grid West will not only have a regional view of the transmission system prior to real-time operation but will centrally mange transmission capacity in an independent manner. This new scheduling paradigm should have the capability to account for and honor all existing transmission rights, along with their full scheduling flexibilities, as well as all acquired IWRs.

4.0 RIGHTS DATA MANAGEMENT

As the central scheduling authority, Grid West will manage available flowgate capacity (AFC). This includes both pre-existing obligations derived from existing transmission contracts as well as incremental obligations due to the creation of new obligations (IWRs) through capacity expansion and the reconfiguration process.

Figure 4.1 – Rights Data Management Stages



[2] The Pacific Northwest Security Coordinator (PNSC) has real-time monitoring of the Northwest's transmission system, but lacking schedule information, it does not have look ahead capability.

4.1 Physical Rights Inventorying

The physical rights inventory will contain aggregated Transmission Owner obligations, certified existing transmission rights (CETRs) and Grid West-issued Injection Withdrawal Rights (IWRs). As opposed to performing a contract-by-contract review, Grid West will initially work directly with the Transmission Owners to determine and accurately inventory their aggregate obligations (TO obligations) related to all existing transmission rights. Hence, at the start there will be no CETRs in the physical rights inventory; however, this segment of data is expected to expand as more and more Transmission Customers certify their ETRs.

The physical rights inventory will be used to support three separate processes: the calculation of AFC, the validation of schedules, the validation of IWR and IRR offers and the operation of the Reconfiguration Service.[3]

4.2 ETR Certification

Transmission Customers with ETRs may want to schedule directly with Grid West and/or participate in the Day-Ahead Reconfiguration Service. To do so, these Transmission Customers must request to have their rights certified by Grid West. For each request, Grid West will work with the Transmission Customer and the impacted Transmission Owner to identify and certify the Transmission Customer's ETRs. ETR certification will produce a set of Certified Existing Transmission Rights (CETRs). Each CETR will include a set of scheduling points and its associated scheduling flexibility, if any.

Once certification has occurred, a Transmission Customer may offer scheduling flexibility associated with the certified right into the Day-Ahead RCS or use the certified right for energy scheduling purposes.

4.3 IWR Translation Query

After a Transmission Customer obtains a CETR, it may consider offering portions or all of its rights into the RCS auction. Since RCS auctions are based on standardized Injection-Withdrawal Rights (IWRs), the Transmission Customer must first determine the specific IWRs that could be released into the RCS based on its CETR (or a portion of it). To do so, the Transmission Customer will submit an IWR translation query. The query will include the source, sink and MW quantity of the portion of the CETR a Transmission Customer is planning to offer into RCS. The query can be for a specific time period (one hour, one day, one month, or one year) or for the entire duration

[3] See the Reconfiguration, Scheduling, and Bilateral Trading White Papers for additional details

of the CETR. The query can be to obtain a single IWR or set of IWRs. Using a flow-based model, Grid West will determine the IWR value of the translation query and send the information back to the Transmission Customer. In cases where Transmission Customers submit translation queries for only a portion of their CETR, Grid West will also provide information regarding the residual value of the remaining portion of their CETR.

Based on this information, the Transmission Customer has the option to offer the translated IWR value into the RCS or to retain their CETR in its original form. If the Transmission Customer decides to offer the translated IWR value into the RCS and its offer is fully or partially accepted, the accepted portion of their CETR will automatically be released into the RCS in the form of AFC with notice to the Transmission Customer. AFC released in this way is used to facilitate the issuance of IWRs requested by Transmission Customers through the RCS process. Any remaining portion of the CETR will be returned to the Transmission Customer and added back to the physical right inventory. This adjusted CETR can still be used for scheduling purposes.

The terms of the RCS auction awards are finite (one hour to one year). Thus, any awarded IWR and/or adjusted CETR will revert back to the original CETR at then end of the auction period.

4.4 Bilaterally Traded Rights Data Registration

Registration of bilaterally traded transmission rights, whether CETRs or IWRs, is another process of RDM. A Transmission Customer that makes a bilateral sale of transmission rights will initiate the registration process with Grid West. Grid West will confirm the transaction through interaction with the selling counterparty and, for ETRs, with the impacted TO. If confirmed, Grid West will register the transaction and update the rights data accordingly.

5.0 RIGHTS DATA FORMAT

The development of a common rights data format is one of the key steps in implementing Rights Data Management. The format should be flexible enough to account for all existing rights/obligations flexibilities and uniform enough to be efficiently stored and accessed. To help explain the concepts described in this paper, an example of the data types and formats are included in Appendix A.

6.0 ROLES AND RESPONSIBILITIES

Table 6.1 below presents the roles and responsibilities of Grid West and its participants related to RDM:

Table 6.1 – Rights Data Management Roles & Responsibilities

RDM Function	Grid West	Transmission Owners	Transmission Customer
Physical Rights Inventorying	▪ Receive, review and compile aggregated TO obligations data ▪ Standardize the format of the right	▪ Provide existing obligation information to Grid West	▪
ETR Certification	▪ Receive, certify and compile Transmission Customer's CETRs ▪ Standardize the format of the right	▪ Participate in the review and acceptance of CETR certification request by Transmission Customers	▪ Request ETR certification
IWR Translation Query	▪ Receive and review IWR translation query ▪ Provide IWR as well as residual CETR information	▪ Assist Grid West with IWR translation query review	▪ Submit IWR translation query
Bilateral Rights Data Registration	▪ Receive and review/confirm registration request ▪ Register bilaterally traded rights data	▪ Assist with registration review	▪ Submit registration request

7.0 MARKET BENCHMARKS

Existing RTOs and ISOs have converted their participants' ETRs into FTRs on a single occasion. After conversion to FTR, the ETRs cease to exist in their original form. One of the distinguishing features of Grid West is that Grid West, through RDM will ensure that holders of existing rights can hold onto and exercise those rights for their entire term. Table 7.1 provides a more detailed comparison of Grid West with PJM, ERCOT and MISO.

Table 7.1 – Rights Data Management Benchmarks

RDM Function	PJM	ERCOT	MISO	Grid West
Rights	▪ No explicit	▪ No explicit	▪ No explicit	▪ Review and

RDM Function	PJM	ERCOT	MISO	Grid West
Inventory	dealing with TOs on existing rights	dealing with TOs on existing rights	dealing with TOs on existing rights	compile TO existing rights data
ETR Certification	▪ N/A	▪ N/A	▪ N/A	▪ Performed once to allow ETR to be directly used by Transmission Customers
IWR Translation Query	▪ One time translation of ETRs to FTRs	▪ One time translation of ETRs to TCRs	▪ One time translation of ETRs to FTRs	▪ Temporary translation of ETRs to IWRs (on request)
Bilateral Trade Registration	▪ Voluntary registration and based only on request by participants and approval by RTO	▪ Voluntary registration and based only on request by participants and approval by RTO	▪ Voluntary registration and based only on request by participants and approval by RTO	▪ Voluntary registration and based only on request by participants and approval by Grid West

8.0 TECHNOLOGY SOLUTIONS

Most of the technology solutions needed for RDM are industry standard products. Table 8.1 provides a summary of such required technologies.

Table 8.1 - Technology solutions for RDM

RTO/ISO	Life of Issued Right
Physical Rights Inventory	Straightforward database forms for entering rights data in a standard structure.
ETR Certification	Straightforward database forms for entering ETR data in a standard structure.
IWR Translation Query	Straightforward database forms for entering IWR data.
Bilateral Rights Data Registration	Straightforward database forms for registering (entering) rights data in RDF structure.

9.0 COST DRIVERS

The cost driver for Rights Data Management is labor due to the manual processes involved. Costs could be reduced if:

- TOs perform existing obligation analysis under Grid West coordination
- Grid West increases the response time for ETR Certification and IWR Translation queries

10.0 DESIGN ISSUES FOR CONSIDERATION IN NEXT DEVELOPMENT LAYER

The next layer of design should include a review of the following design issues:

- *Inventory Granularity* – In order to accurately determine the existing obligations on the transmission system, how granular does the rights inventory need to be? Does the level of granularity need to change over time (e.g. after the 2 year transition)?

- *Netting for Certified ETRs* – Transmission Customers that choose to schedule directly with Grid West should certify their existing rights. As a result, Grid West will have to net their right and the flexibility associated with it out of their TO's aggregated obligations. The netting process needs further work from both process and technical viewpoints.

- *Netting for Translated IWRs* – As translated IWRs are offered into RCS and are potentially traded/awarded, they reduce the existing scheduling flexibility (ESF) of their underlying CETR. The calculation of the remaining ESF, for potential offer into DA-RCS, requires further work from both process and technical viewpoints.

- *Universal data format for ETRs* – Although Right Data Format presented in Appendix A is expected to cover most of all possible ETR contract forms, additional work is required to devise a universal format, if at all possible, that covers all possible ETR contract forms and at the same time can be electronically managed.

- *Direct Issuance of IWRs from Translation* – As described above, IWR Translation Query allows a Transmission Customer to release IWRs into RCS, but IWRs used for scheduling can only be obtained by purchases made in an RCS auction. In future work, thought needs to

be given to whether IWRs could be directly issued from a translation request and used for scheduling without going through the RCS auction.

APPENDIX A - SAMPLE RIGHTS DATA FORMAT:

Rights Data Format (RDF) development is a critical step in implementing the RDM. RDF should be flexible enough to account for all existing rights/obligations flexibilities and uniform enough to be efficiently stored and accessed in industry standard data storage technologies, e.g. relational databases. For this purpose we will use a format that contains the following information:

1. Right Identifiers: Uniquely identifies each right;
2. Right Owner(s): Identifies entity(ies) who own such right, if applicable;
3. Right Authorized Representative (RAR): Identifies the entity that can interface with Grid West regarding rights use and finances (this is expected to normally be the right owner);
4. Right Status/Origination: Identifies the status/history of the right including its origin within a right, if applicable;
5. Right Duration: Identifies calendar duration of the right (e.g., from now till 2050);
6. Right Timeline: Identifies duration of the right applicability (e.g., summer 2006 peak);
7. Right Injection Point(s): Identifies all scheduling point(s) that can be used as the right injection point(s);
8. Injection Right Value(s), or value ranges, at individual Right injection point(s): Identifies injections right MW value, range of values, at individual injection point(s);
9. Right Withdrawal Point(s): Identifies all scheduling point(s) that can be used as the right withdrawal point(s);
10. Withdrawal Right Value(s) [or value range(s)] at individual withdrawal points: Identifies injections right MW value, range of values, at individual injection point(s); and
11. Overall Right Constraint: Identifies a overall constraining factor on an existing right/obligation (ETR) such as the fact that total injection right where rights are presented in a range is limited.

The following table is intended to show this general format for an 800 MW flexible multipoint-to-multipoint right, held by Grid West participant "GWP2" through 2020, from scheduling points A, B and C to scheduling points U and V where

injection and withdrawal rights at every one of these scheduling points is also a variable as follows:

- Up to 400 MW injection right at scheduling point A
- Up to 300 MW injection right at scheduling point B
- Up to 300 MW injection right at scheduling point C
- Up to 400 MW withdrawal right at scheduling point U
- Up to 600 MW injection right at scheduling point V

The flexibility is shown in Table A.1.

Table A.1: Uniform Right Data Format

Right Attribute	RDF Value
Right Identifier	ETR2-MPtMP-2020
Right Ownership	GWP2
Right Authorized Rep	GWP2
Right Status/Origination	ETR2-GWP2
Right Duration	Now to 12/31/2020-HE24
Right Timeline	Regular
Right Injection point(s)	Buses A & B & C
Injection Right value(s)	$IR_A \leq 400MW$ & $IR_B \leq 300MW$ & $IR_C \leq 300MW$
Right Withdrawal point(s)	Buses U & V
Withdrawal Right value(s)	$WR_U \leq 400MW$ & $WR_V \leq 600MW$
Overall Right Constraint	$[IR_A + IR_B + IR_C = WR_U + WR_V] \leq 800$

The format presented in the above table is flexible enough to hold all information about the rights and can be readily implemented within a relational database framework.